Concrete

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The Uncommonness of Common Labor

FATHER and son may be architects or engineers or butchers or bakers, but father and son are not often common laborers; that is, for any great length of time. This is something that has to be considered in connection with our National problem of immigration. The serf class must be had. There is a certain amount of work that has to be done in order to keep the skilled mechanics going. While skilled mechanics generally may keep to a given line of work for several generations, a factory mechanic nowadays, under machinery production, is such a specialized order of workman that he is likely to be created out of the common laborer of yesterday. The trend is always up. We need to bring in more people to do the common chores of life, simply because those people who have been here for a generation are not willing to do them. A man's illiteracy does not incapacitate him for a very necessary kind of service. Illiterate immigrants are not likely to be soap-box disturbers. Some of our best people's grandfathers were illiterate. Who are the *best people* anyway, if not those who make themselves most useful? Certainly they are not all useful who wear white collars.

Busy Time for the Builder of Houses

WHILE the recent unprecedented building totals are showing some decline, it is not to be assumed that building is due for a sharp drop and greatly reduced prices. City business building is slackening but builders who do the suburban residence work should be very active for several years to come.

We have perhaps got into a notion of reckoning too much on cycles and because building has been extremely active, assume that it will fall off sharply on the nether side of the peak. This reckoning is without giving full weight to the demand for homes—the suburban trend. It has long been pent and is letting loose now from the cities to the green fields. This activity is serious and stubborn enough probably to prevent a serious decline in prices.

A man who waits a year to build his home *may* save a little money; if he waits five years, he may save a good deal; but savings are not to be computed merely in terms of building material and labor costs. The prospective home owner figures differently. A five year wait is five years without a home, with all the attendant waste (so far as he is personally concerned), of spending without investment. He pays for the building whether or not it is his. Buying and selling is one thing—*living* is another. The renter is coming to see that he can't "beat the building game," as the saying goes, by not building.

This movement of the individual home owner is very strong. The house builder should have some active years and his activity is due to take up a great deal of the slack made by the postponement of commercial building projects and at the same time postpone the day when the commercial building investor can count on any large saving in building costs. The small builder will effectively break the fall of building costs—let them down easily, no doubt over several years. That, for the most part, is the view of Roger Babson and others who keep a close grip on the pulse of things.

Keep Equipment Prices Down

MEN who sell contractors equipment, organized, as the Associated Equipment Distributors, with headquarters in Milwaukee and members over a large part of the country, urge that prices of contractors equipment be kept down in order to encourage the present building pace. They have sent to their principals, the manufacturers, a letter on the subject, signed by M. R. Hunter, secretary, from which the following is quoted:

> Our members report that business at present is good and has been getting better for some several months. Let us try and keep it good.
>
> Most firms and individuals in business have had difficulties the last few years and many have lost money getting through the trying times of readjustment.
>
> This letter is written to you as a manufacturer to seek your cooperation with the Associated Equipment Distributors in trying to aid us now that business is good, by keeping prices down.
>
> You will remember the last time business was good the duration of that period was all too short. You will also remember one thing that stopped good business was the "Buyer's Strike." What caused the "Buyer's Strike?"—Terrific Price Increases.
>
> Prices simply kept going up until the buyer had a natural reaction and decided not to buy until things got back to a reasonable level.
>
> We realize you, as an individual manufacturer, are impotent to handle the situation, but through the efforts of each and every manufacturer bringing the same question up to the people that they buy raw materials from, and through doing what can be done to keep the prices down, it will be bound to have some effect.
>
> If we can get enough people, enough manufacturers, enough distributors, enough raw material interests, to keep in mind that a rapid advance in prices will kill the whole thing, we will have accomplished considerable towards keeping business good for at least one year—something that has not been accomplished in the construction equipment field for a good many years.
>
> The minute prices raise to the point the buyer puts on the brakes, we are all in for a ride down hill again.
>
> We wish to advise our principals that a continued rapid advance in prices will mean a decided curtailment in the buying of new equipment and slowing up in the distribution and will influence the proposed buyer in resorting to second-hand equipment and other means of avoiding the payment of excessive costs.

"Build in 1924"

By George Woodruff

Vice President, The National Bank of the Republic, Chicago, Ill.

From an address delivered before a meeting of the representatives of the building trades held at Orchestra Hall, Chicago, May 23, 1923

IN VIEW of existing conditions it is of great importance for us to note that at the present time there are indications that increasing costs will slow up building activities and that there are many current reports of a buyers' strike. Of course, if such a "strike" should come about there may develop a belief that it will be well to wait for a very considerable fall in building costs before going ahead with building contracts and this would be a very unfortunate development, because if our building activities are now interrupted the chief support of prosperity will be withdrawn and some degree of business recession will follow. It would therefore seem as if those who are engaged in the building industry could render a great service to themselves and to the country if they were now promptly to adopt the slogan, "Build in 1924," for such a slogan would tend to hold costs down during 1923, prevent any undue spread of the talked of buyers' strike, and at the same time keep the people of our country in a mood to build. Prospective building activity in 1924 would tend to convince the people that it would be unprofitable to cancel building plans with the idea of waiting for prices to go to the "bottom," as an active year in 1924 would mean that there would be no "bottom" for some time to come.

Possible Prolonged Prosperity

While all well informed business men admit the possibility of a moderate business recession before the end of the year, nevertheless it would seem that those engaged in the building industry are the "pinch hitters" who may be able largely to prevent this threatened slump. If our present building activity proceeds to fall down, the ensuing business recession will considerably decrease our prosperity until we can gather ourselves together for a fresh start, but if the building industry is able to tide us over into 1924 we may then find that a settlement of European social and political questions will make possible the sale of large amounts of foreign securities to American investors, and the proceeds of the sale of these securities would be used by Europe for the purchase of American goods. Such a development would prolong our prosperity for some time to come, because of the manufactured goods that would be shipped to foreign shores and because of the increased purchasing power of the grain growing sections of our country that would follow the increased demand for agricultural products on the part of the people across the sea.

Upon the intelligence, team work and vision of American builders now depends the immediate continued prosperity of the nation.

What Is Concrete?

One of the definitions in the recently adopted report of the American Concrete Institute's Committee G4—Nomenclature is:

25. *Concrete*—A compound of gravel, broken rock or other aggregate, *bound together by means of* hydraulic cement, coal tar, asphaltum, or other cementing materials. Generally, (*always in the specifications of the American Concrete Institute*) when a qualifying term is not used, portland cement concrete is understood.

It appears according to the Institute *News Letter* of May 23 that there are three divergent views of this definition, as follows:

(1) The committee holds to the policy to make its definitions fundamental and as broad as possible. (In this case upholding in the main the current dictionary definition).

(2) Other Institute members hold that by common and by technical usage "concrete" means portland cement concrete unless preceded by modifying adjectives. And that such committees as G-4 and such technical bodies as the Institute *create* dictionary definitions, rather than follow them.

(3) This third view is very close to No. 2, but adds the thought that to specify the name "portland" in the definition is too narrow and assumes that portland cement is the last word on the subject; this group would use the general word "hydraulic" to describe the cement which is the binder of concrete, with the idea that cement manufacture is not a stagnant field and that a new cement might later require a modified definition—easy enough to an Institute Committee—but difficult and slow in the public press and the popular mind once some other conception is deeply rooted.

Radio Tower of Reinforced Concrete

Tokio, Japan, has a reinforced concrete radio tower which is one of the highest structures in the world. Its 672 feet taper from an internal diameter of 55 feet at the base to 6 feet at the top. There is a stairway inside the shell, which opens onto balcony landings at various levels.

Construction and design are very much the same as in a reinforced concrete chimney, excepting that temperature stresses do not have to be considered. The marked success achieved with this tower indicates that structures of much less size are entirely practicable. The existence also of thousands of reinforced concrete chimneys varying from 100 feet or less to over 350 feet, in the United States, suggests this construction as a most promising one for high radio towers where buildings are not available.

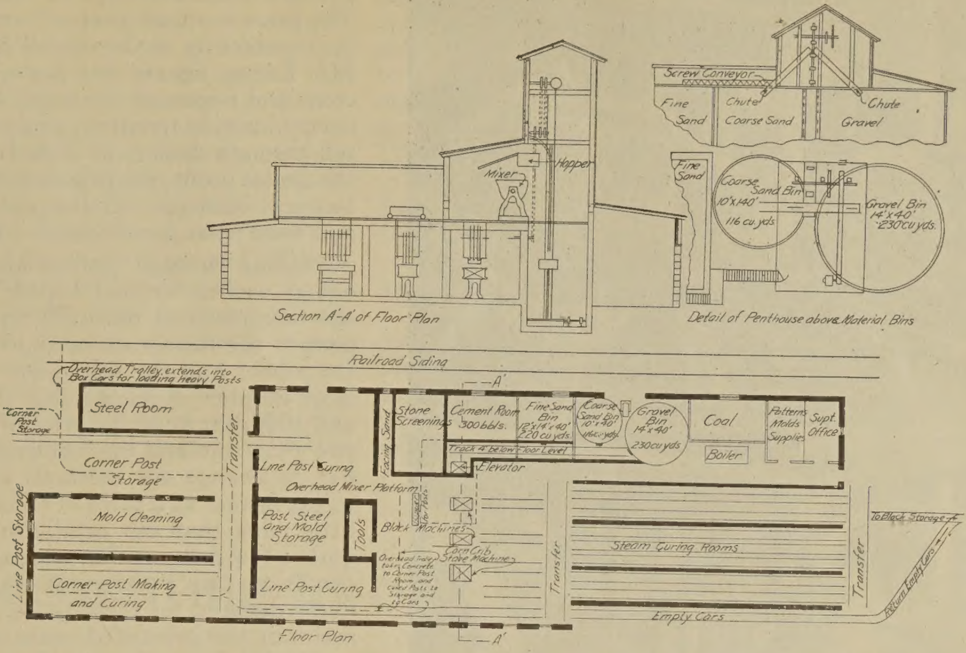


Fig. 1—How the Davis-Ewing Fence Post Plant is Laid Out

Building Up a Fence Post Business in Illinois

Fence post plants operated with commercial success are not common. Several railroads have plants and make posts for their own use; numerous concrete products manufacturers have a few post molds of one type or another but have never considered the manufacture of posts as anything but a side line. The Davis Ewing Concrete Co., Bloomington, Ill., making the Staple concrete posts, is an exception.

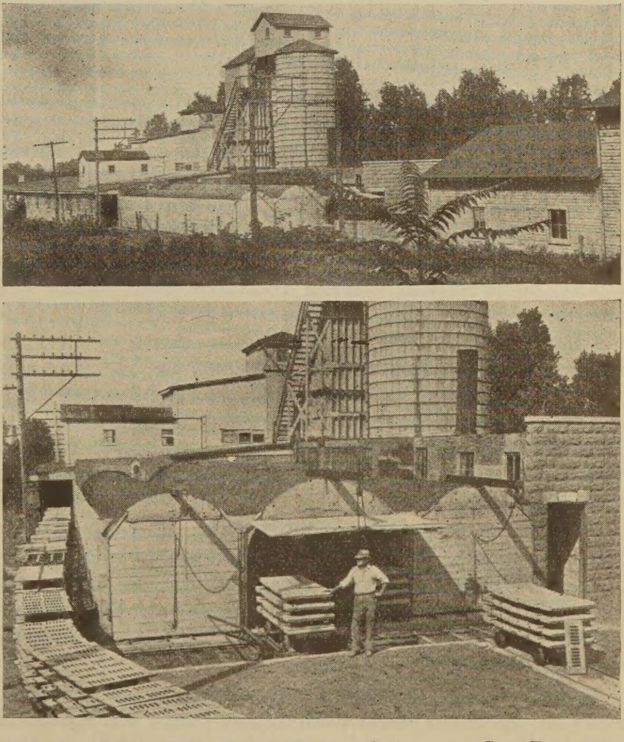
The plant is shown in plan and elevation in Fig. 1, while Figs. 2 and 3 are good exterior views from photographs. The place was designed as a post plant first of all and in normal times before a slump in farm demand 70% of the company's business was in posts and 30% in blocks.

Figs. 4 and 5 show a method of making the posts which has been discarded for a better way. The pictures are shown for the sake of comparison with the methods now used, shown in Figs. 6 and 7. The first method is not nearly so rapid. By the discarded method (Figs. 4 and 5) a man carries the concrete from the mixer to the molds in the iron pocket or skuttle (Fig. 4) and each mold is filled separately. Fig. 5 shows the man inserting the stapling composition and troweling after which the filled molds are placed in racks on the cars and moved into curing rooms. This method is the one commonly used.

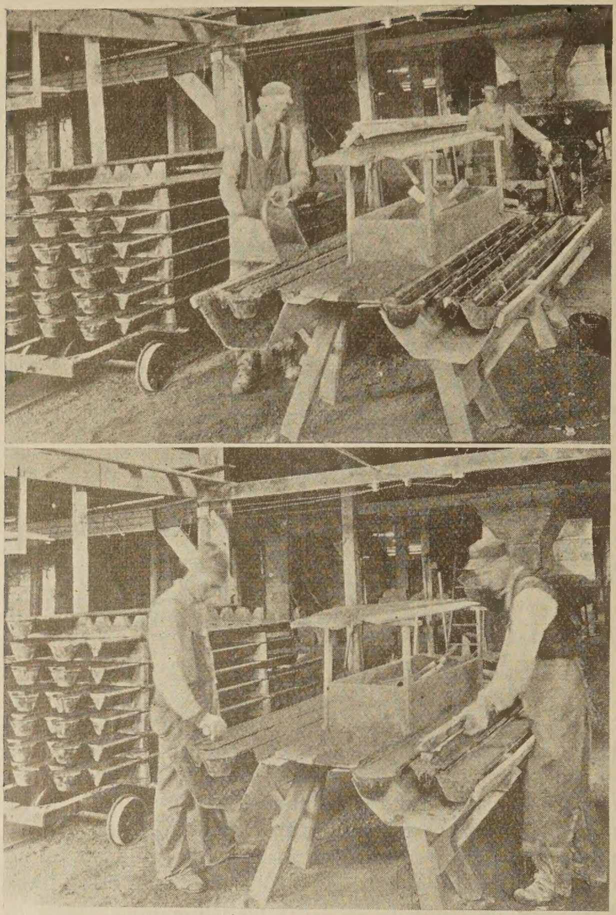
By the more rapid and economical procedure the molds are set up on the car (Fig. 6) and filled at a chute by raking the concrete into the molds after the steel has been placed in them. The second man levels off the concrete. The car is then moved to a point near where the posts are to be racked into position for curing and at this point two other men take the car. One man is shown (Fig. 7) inserting the stapling composition and the other man troweling up the surface of the post after the composition has been inserted. The posts are then racked into position as shown and left to cure for three or four days.

Molds are emptied in the curing rooms; posts are placed on one industrial car and the empty molds on another. The posts are shoved north past the corner post storage (see Fig. 1) to the point indicated for the line post storage and the car containing the empty molds is transferred into the room for mold cleaning. When cleaned and oiled, the molds are transferred back to the mixing room to go through the same operation.

The concrete for the corner posts is transferred by means of the overhead trolley as shown by the dotted lines (Fig. 1) from the hopper to the corner room shown for corner post making. The large molds are here filled and left until cured and the posts are then easily handled by one man on this trolley out into the yard for storage or directly into car for loading. The molds are not re-



Figs. 2 and 3—The Davis-Ewing Concrete Co. Plant at Bloomington, Ill.



Figs. 4 and 5—This Method Has Been Discarded for the Better Way Shown in Figs. 6 and 7

moved from this room but are cleaned and oiled in place and filled again.

Examination of this plan also shows that the output of the block and stave machines is placed on industrial cars on the short spur tracks and when filled these cars are transferred into the steam-curing room and then to the block storage in the front yard. The blocks are then available for handling by truck.

In this way the posts, which are not given steam-curing because of the wetter concrete used, are all sent to the north and stored in the open air and the blocks and other drier mix products are sent into the steam rooms which are in direct line with the block storage yard. These blocks are usually delivered in town by trucks.

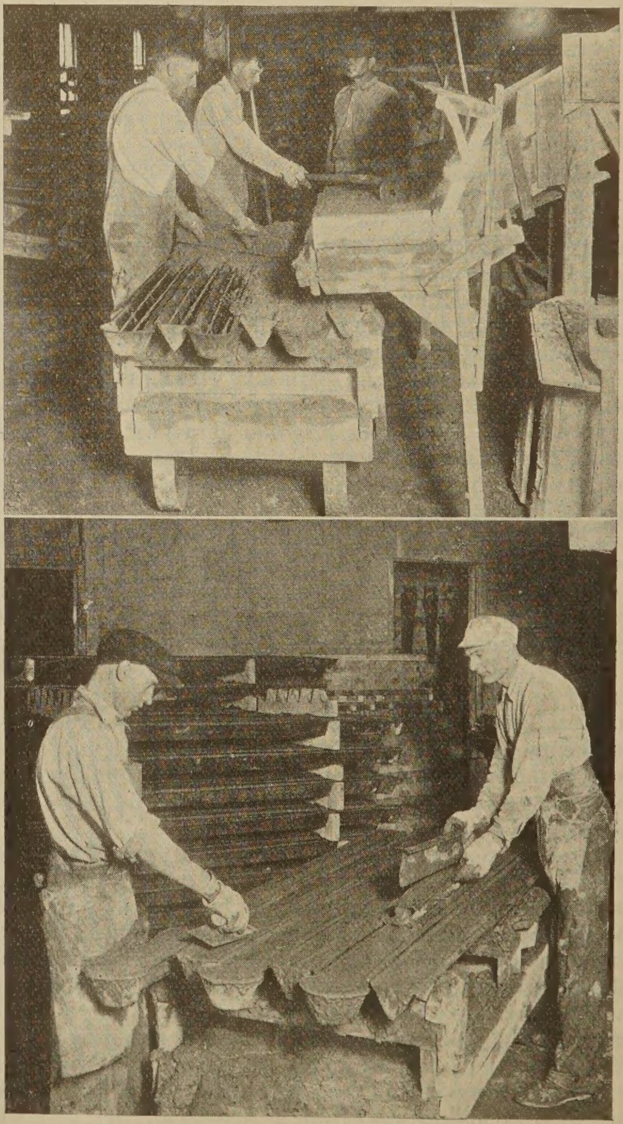
This business was started about 16 years ago. The first posts made were of a type from which the molds were removed at once, leaving the posts on pallets. This required a rather dry mix and in Mr. Ewing's experience did not work out well, the reinforcing tending to separate the concrete in the thin section into lines of cleavage. Four years later he began making Staple posts, having a special nailing mixture to receive nails or staples.

"We have found the manufacture of these Staple concrete posts more than satisfactory," says Mr. Ewing. "They are a practically fool-proof article to manufacture and the posts have given such satisfaction to our customers that we have made many friends by the sale of them."

Originally the concrete posts were sold direct to users at 35 cents each with cedar posts selling at 25 cents. Farmers were slow to adopt them but as contracting and not products' manufacture was then Mr. Ewing's chief activity, he was satisfied to go slowly. The price went up gradually to 55 cents and on giving up contracting to devote all his time to manufacture, Mr. Ewing figured his costs, raised the price to 65 cents and began advertising. Inquiries were many and covered a wide territory, so arrangements were made to sell through dealers in each locality. To take care of the dealer profit, the price was fixed at $1.10 and a good business built up. Cedar posts sold then for 80 cents, and steel posts for 60 cents. This did not last.

"Selling through dealers and jobbers did not work out as well as we had hoped," says Mr. Ewing. "In the first place, it naturally increased the price of the post to the farmer on account of the commission paid the jobber and the salesman. However, we did sell a large number of posts under this arrangement in 1919 and 1920, but when the price of farm products fell about two years ago and the farmer quit buying we naturally had to change our methods and tried to sell directly to the farmer at a price of 65 cents per post, which was little more than our total cost. We have been selling quite a few posts at this price and now that the farmers' conditions are very much improved we anticipate a lively demand for these posts. It may be that we will maintain this price of 65 cents each for the present. With a price of 55 to 60 cents for cedar, we could readily get 80 cents.

"We have no competition in the way of concrete



Figs. 6 and 7—The More Economical Manufacturing Method posts. This type of post has been made now for nearly 20 years and has given satisfaction. It weighs from 50 to 52 lbs. Our patented method of holding the rods in place by means of placing plates insures the accurate placing of the rods in the concrete with the result that every post develops uniform strength. Our success in manufacturing these posts has been such that we guarantee without reservation every post we make to give satisfaction, with no time limit specified. Our nearest competitor is a good cedar post, but these are selling for about 55 cents at the present time and you can readily see that the farmer is willing to pay a slight additional margin for our post. Steel posts are selling for 35 to 45 cents each but are gradually being recognized as temporary only.

"The concrete in these posts is so dense that we have had absolutely no complaint about water penetrating the concrete or reinforcing bars corroding. We make our concrete of the very best materials obtainable in a proportion of 1 cement to 1½ washed and crushed gravel to 1½ torpedo sand. This concrete is mixed to a plastic condition and worked while still in the molds by vibrating. Vibrating works out all the air and settles the aggregate closely around the steel. This results in a very dense post.

"We find that the stapling composition is just as durable as the body of the concrete in the post and it does not get too hard to receive the staples even after years of curing. There is no sawdust or any other similar material in this composition. It is nothing more or less than steam cinders mixed very carefully with cement in the proportions we have found to be best. The composition unites with the body of the post, thus forming a homogeneous mass which does not show any crevice along the joints or edges of the composition strip."

Cost Accounting in Stave Silo Erection

By Mac Hanson

> The author says: I am not satisfied with the basis of distributing overhead expenses that I have used. I have never had the privilege of seeing any other erector's cost system, nor have I ever seen a discussion in the trade journals. I would be pleased if any reader would offer suggestions for improvements on this system, or even adversely criticize it through these columns.

It is impossible to work out a cost finding system that will fit the case of every silo erector. There are two dozen or more different makes of staves on the market with their different sizes, weights, shapes, etc. The number, kinds, and sizes of rods vary. The system of erection work is different with different staves. The conditions under which silos are sold and erected are different as to number of men used, their room and board, the manner of getting to and from a job, the style of scaffolding, the kind of finishing done, etc. But a general scheme of the accounting will apply to all. It is merely necessary that you know definitely the facts concerning the above things, upon which the accounting system is based, in order to understand the system itself. It has often been urged and would simplify matters, to use the single stave as the unit in figuring the costs of erection. There is one big objection to this. The cost per stave varies with each diameter of silo and with each different height in any one diameter. The system presented uses the production labor basis—the number of days of erection labor required. Practically the same objection applies to this as to the "Per Stave" basis. It does, however, run a little more uniform for various diameters and heights.

The style of silo, the kind and sizes of materials, and conditions of erection under discussion are as follows: The stave is 10 in. wide and 28 in. high. It is banded with $\frac{9}{16}$-in. round rods every 28 in., one malleable tank lug per rod. No spreaders are required. The silo is glazed with cement inside when erected. Three men form the erection crew. All labor is furnished by the erector. The men drive back and forth to work each day. Their scaffolding and tools are carried in a trailer behind their automobile. Silos are sold by local agents who receive a commission of 16⅔%. A royalty is paid by the erector on each silo built. The farmer pays the freight, does all hauling, digs the pit, furnishes cement and gravel for the foundation and cement for the glazing. The erecting crew does the labor of building the foundation and of glazing the silo. Chute, roof, outside ladder, and other accessories, are not covered in this discussion. Two door blanks are used underground (in the pit) and door frames the rest of the height.

Two cost forms are presented: Table 1, Overhead Expenses Estimate Sheet of Cost of Materials, and Table 2, Production Cost Estimate Sheet. The system of keeping the cost accounting proper and the forms used are quite similar to those discussed in these columns in former articles on Cost Accounting, dealing with manufacturing plant costs. The expense items in Fig. 1 are readily understood. "Storage Charges" includes a proportionate charge for room occupied, labor of handling and re-handling, theft or loss of pieces, etc.

I can see only four bases of distributing burden, viz: percentage of the sale price basis, ton capacity basis, per stave basis which is really a materials used basis, and productive labor basis. By this latter I mean on the basis of the number of days it takes to erect any size of silo. The first is unusable because it is the sale price we are trying to find. The second is absolutely wrong because to get the same tonnage capacity in different diameters of silos, different amounts of materials and of labor are required. The per stave basis was discussed before. Until some one can suggest a better basis, I will use the productive labor basis.

I have dwelt a great deal in this and former discussions on this subject of the "basis of distributing overhead costs" in the Production Cost Estimate Sheets, because these sheets are so vital a factor in your success at profit making. Your quotations and bids are made from them before you have any cost accounting sheets proper for a safer guide. For instance, a large percentage of your silos is sold before a single one is erected. And you can't run any Cost Accounting Sheets proper until after silos are erected. If your

OVERHEAD COST OF MATERIALS

SILO ERECTION

Wood for doors complete	Ladders & castings	Silo lugs	9/16" rods short weigh - 12# long weigh - 15#	3 scaffolds original cost$900
1 door ....80 1 bar ....05 1 bolt........03 1 fastener....25 painting......12 storage 05	1 ladder rung .18 2 ladder castings .15 freight & drayage....01	1 lug..... .075 freight & drayage.....005	1 short rod .... .36 freight & drayage ....04 painting .... .02 storage .... .03 additional cost of 1 long rod ...... .11	Interest....... 54. depreciation ..180. repairs & up-keep ....115. storage charges 16.
1.30	.34	.08	.56	365.

Production Cost Estimate sheets are not safely and carefully made out, you can easily and quickly get in very bad.

Since we never know in advance what diameters and heights of silos, nor how many of each, we are going to sell in any one year, we are forced to adopt a standard sized silo, based on the experience of previous years, as the basis of figuring the annual output and annual production labor required on that output, and then distribute the annual estimated overhead expenses on this estimated annual production labor basis. The manufacturer we are considering, the one whose manufacturing layout we presented last month in this series, has found that his average sized silo is the 12 x 35 size. He erects a large number of 10-ft. and 12-ft. silos, quite a few 14-ft. and very few of 16-ft.

1922 PRODUCTION COST ESTIMATE SHEET ON SILO ERECTION — Based on 329 days of Productive Labor

16x35	14x35	12x35	10x35	Daily 1/329 Overhead Expenses	Annual Overhead Expenses	
4½ days	4 days	3½ days	3 days			No. days labor to Erect
840 178.92	735 156.56	615 131.00	510 108.63			No. Staves Amt. 21.3
14 9.10	14 9.10	14 9.10	14 9.10			No. Frames Amt. 65¢
2 1.20	2 1.20	2 1.20	2 1.20			No. Blanks Amt. 60¢
....	....	....	....			No. Glazing Amt.
14 18.20	14 18.20	14 18.20	14 18.20			No. Bar doors Amt. $1.30
13 4.42	13 4.42	13 4.42	13 4.42			No. Ladders & Castings Amt. 34¢
64 5.12	48 3.84	48 3.84	32 2.56			No. Silo lugs Amt. 8¢
64 short 28.80	16 short 32 long 8.96 14.40	48 short 21.60	32 long 17.92			No. Rods Short—45¢ Long—56¢ Amt.
4½ days 38.25	4 days 34.40	3½ days 29.75	3 days 25.50			No. Labor Common 25¢ Amt. Foreman 35¢
284.01	251.08	219.11	187.53			PRIME COST
						INCIDENTALS
2.70	2.40	2.10	1.80	.60	197.40	Compensation Ins.
4.50	4.00	3.50	3.00	1.00		Chore labor
.68	.60	.53	.45	.15		Small Tools
3.05	2.80	2.45	2.10	.70		Mishaps
10.93	9.80	8.58	7.35	2.45		SUB-TOTALS
						VARIABLES
20.25	18.00	15.75	13.50	4.50		Auto Erecting Trips
....	....	....	....	....		Board and Room
1.80	1.60	1.40	1.20	.40		Culls & breakage
....	....	....	....	....		Int. on Money in Silo
3.38	3.00	2.62	2.25	.75		Guarantee Expenses
2.02	1.80	1.58	1.35	.45		Trailer Exps.
....	....	....	....	....	..	Taxes
....	....	....	....	....		R. R. carfares for Men
2.25	2.00	1.75	1.50	.50		Auto Trips for Shortage
29.70	26.40	23.10	19.80	6.60		SUB-TOTALS
						FIXED CHARGES
4.05	3.60	3.15	2.70	.90	365.00	Scaffold Exps.
....	....	....	....	....	....	Int. on Investment
4.05	3.60	3.15	2.70	.90		SUB-TOTALS
						ADMINISTRATIVE
35.20	30.40	26.60	22.80	7.60	2500.00	Gen. Mgr's. Salary
7.20	6.40	5.60	4.80	1.60	520.00	Clerk's Salary
.45	.40	.35	.30	.10		Office Overhead
.45	.40	.35	.30	.10		Office Supplies
1.35	1.20	1.05	.90	.30		Association Dues & Expenses
1.35	1.20	1.05	.90	.30		Legal Expenses
2.25	2.00	1.75	1.50	.50		Life Insurance (Protection)
1.80	1.60	1.40	1.20	.40		Telephone and Telegrams
50.05	43.60	38.15	32.70	10.90		SUB-TOTALS
						SELLING
24.75	22.00	19.25	16.50	5.50	1800.00	Sales Mgrs. Salary
.45	.40	.35	.30	.10		Office Overhead
.45	.40	.35	.30	.10		Office Supplies
2.70	2.40	2.10	1.80	.60		Bad Accounts
95.37	84.67	73.34	63.10	Actual		Commissions
15.00	15.00	10.00	10.00	Actual		Royalties
45.00	40.00	35.00	30.00	10.00	3290.00	Advertising
3.37	3.00	2.62	2.25	.75		Collecting
.45	.40	.35	.30	.10		Adjustments and Discounts
4.50	4.00	3.50	3.00	1.00		Loading, Outbound
1.35	1.20	1.05	.90	.30		Auto Expenses, General
193.39	173.47	147.91	128.45			SUB-TOTALS
572.13	507.95	440.00	378.53			TOTAL COST
63.57	56.44	48.89	42.06			PROFIT 10%
635.70	564.39	488.89	420.59			SALE PRICE

diameter. Most silos are in the 30-ft. and 40-ft. heights, quite a large number in the 35-ft. height, a few in the 49-ft. height, with scattering ones between these limits. His production output of staves manufactured, you remember, was 200 days averaging 300 staves per day, a total of 60,000 staves. He allows 636 staves for a 12 x 35 silo, which includes 1% for breakage in shipping and hauling which he stands. Any greater percentage of breakage must be borne by the purchaser. Sixty thousand staves will build 94 silos, 12 x 35, with a few staves left over. Experience has shown him that it requires 3½ days to erect a 12 x 35 silo complete without roof, chute or floor. 94 × 3½=329 days annual productive labor over which to distribute his annual overhead burden. He has more than one erection crew at work, of course. On his Production Cost Estimate Sheets he enters figures for each diameter of silo, because the other Prime Costs—materials—also vary with the diameter of the silo, the same as the overhead costs and productive labor vary.

With this explanation, Table 2 should be easily understood. No entry is made under Glazing because the erector furnishes only labor, buckets and brushes for this. Labor of glazing is included in Productive Labor, and buckets and brushes in Small Tools. The item Board and Room is shown merely to have it in the list for those who do have such an expense. Interest on money tied up in silos is left blank because most erectors make settlement the day the job is completed. Royalties and Commissions are entered at the actual figure for each size of silo because Royalties are actually known for each size of silo and Commissions can be determined, since they are 16⅔% of the sale price. That is, all of the other expenses except Commissions—Prime Costs and Overhead Costs both—added together give 83⅓% of the total cost price. Commissions is the other 16⅔% of the cost price. Guarantee Expenses covers all expenses of any kind incurred in making a silo good if some fault later develops in it. Auto Trips for Shortage covers the expense of chasing back to the factory for materials short on the job, as lugs, rods, door frame, etc. The item Mishaps is used to cover any expenses of accidents occurring to the workmen or to the silo while being erected. The workmen are protected by Workmen's Compensation Insurance, or Liability Insurance, but no whole-hearted erector is satisfied to let his injured men put up with this small remuneration. We hate to have our boys get hurt as badly as they hate to get hurt and are going to see to it that they lose nothing in wage earning while off duty and that they have every convenience and help we can give. Mishaps could have been styled Extraordinary Contingencies.

As stated in a former article, the hardest thing to get any silo erector to appreciate, who does not at present have a cost finding system, is the excessively large number of overhead expenses connected with silo erection. That is one reason why there is such ruinous competition in this silo game. Manufacturers and erectors who have some idea of their actual costs are forced to do business on a very small margin of profit in order to stay in the game and keep their investment alive. The other fellow isn't a blockhead. He is a prince of a good fellow with as much common sense as any of us. Only he doesn't know his costs in the total, doesn't know how to figure them, doesn't know the value of a cost accounting system, doesn't know how to start, to keep, and to read one even if he does think well of its value. We all understand that every erector has to have some way of figuring costs. The trouble is that so many do not have systems that are complete and accurate enough to show the true state of affairs. Even the system here presented has many serious faults.

I once had a competitor go over this system, Fig. 2, and state his own figures for each item on a 12 x 40 silo. I added them as he gave them and his own figures showed that the silo was costing him more than his printed sales price. I urged him to raise his sales prices, as he was giving me serious competition, and he replied, "Oh, Hanson, there is something wrong with that cost system. I am running an inventory today. As soon as I get it completed I will know what I am making. You can't sell silos at that price." His remark illustrates two things. When we first keep an accurate cost accounting system, we are astounded at the situation presented to our eyes and, like my competitor, will refuse to believe our own figures. Again, too many erectors depend upon an inventory to tell them whether they are making money. An inventory will give you some idea of this, if—(a big if)—you know how to interpret an inventory. My friend mistook his surplus for a net profit.

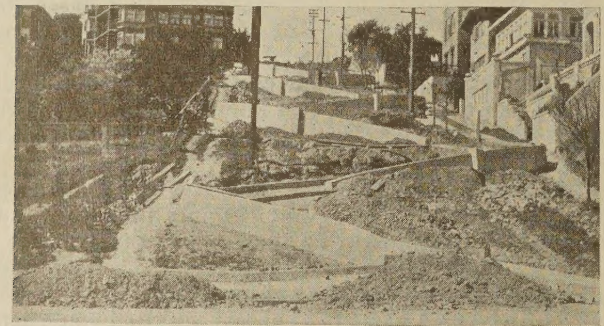
The health and prosperity of business in general in these United States is of great concern to all of us. America is the business nation of the world, owing to its size, natural resources, and the native tendency of its individual citizens. Yet a large percentage of business men knows too little about cost accounting. Worst of all, we don't seem to be much interested in it. I don't know of any one thing that is of such vital importance to the success of profit making in any business as an accurate knowledge of costs. Yet I have talked to many silo erectors about costs of erection and tried to get them to give serious study to this system, men who are doing a very large annual business, and I have practically had it insinuated to me that I am a bore, a nut on the subject. I am. But it seems to be a stubborn trait of human nature that we have to be bored to death before we will do those things that are for our own success and good. Sad experience seems to be the only teacher but too often we are listed among the "also rans" by the time sad experience has gotten her lesson across.

Selling has a fascination for most American business men. We are good at it. Manufacturing has a like fascination. We are good at that. These two things hold sway to the exclusion of a knowledge, or even a desire for knowledge, of our costs. We are absolutely punk as cost finders. Yet a knowledge of costs is the most important of these three elements of business success.

Then why is the United States the best and richest business nation in the world? Simply because we are so good at manufacturing and selling that we get a volume of production so large that our overhead costs are spread thin on any one unit of production. Most of our business men who are a success can't tell you where, nor why, nor in what percentage their profits are derived on any one single product they manufacture. The American business man is getting to realize and understand the value of accurate cost accounting to a greater degree than ever before because of the efforts of firms selling cost finding systems, of firms doing a professional accounting service, of the continuous educational efforts of trade journals, and because of the necessity for it occasioned by the income tax law. We have asked and answered one question. Now let us ask another. Why are there so many business failures in the United States? The answer to this question—and you know what that is—gives us the other side of the matter and proves the value of a knowledge of costs. That is enough of preaching. A short sermon is more effective than a long one.

You will notice in Table 2 that I have used the Cost of Manufacturing, 21.3c, as the price of a stave entered on this sheet instead of the Sale Price, 23.7c of a stave. These two prices are shown in Fig. 4 of the preceding article. The use of the Cost of Manufacture price is not good business practice nor is it fair to a manufacturer. But, again, he is forced to do so because of an un-enlightened competition. Each silo manufacturer is both a manufacturer and a retailer. According to the present system of business in the United States, he is entitled to at least two profits, a manufacturing profit on staves, and a retailer's profit on silo sales. He actually gets but one profit, and it is small. A shoe manufacturer sells to a jobber, who sells to a retailer, who sells to the trade. Three profits are taken and custom O.K.'s the procedure. An implement manufacturer sells to the retailer and he to the trade. Two profits are taken. A silo manufacturer makes the staves and sells them direct to the trade and takes but one profit. The silo man is deserving of lots of credit on his way of doing business—direct from manufacturer to consumer. He is deserving of lots of profit, too, for the service rendered. He gets neither here. Maybe he will get both in the hereafter.

The purpose of any cost accounting system is to tell you what your costs are in full detail, in full kind, in full total; to tell you exactly where each is located; and to tell you why each occurred—the what, where, and why of things. A properly kept cost accounting system is thus a continuous and a running history of your business transactions. The knowledge thus gained will show you the leaks, the excessive expenses; will show the need of special study of various departments; will suggest ways to reduce costs; will show where the long profits are located and where the short ones; will discover the unprofitable lines of endeavor; will point out the necessity and the means of increasing the volume of business; will prove the necessity of diversified manufacture; will demonstrate the advisability of increase of investment or curb the desire to expand; in fact, will put the manager in complete possession of facts necessary for business success and will put him and keep him on the right road for profit making.

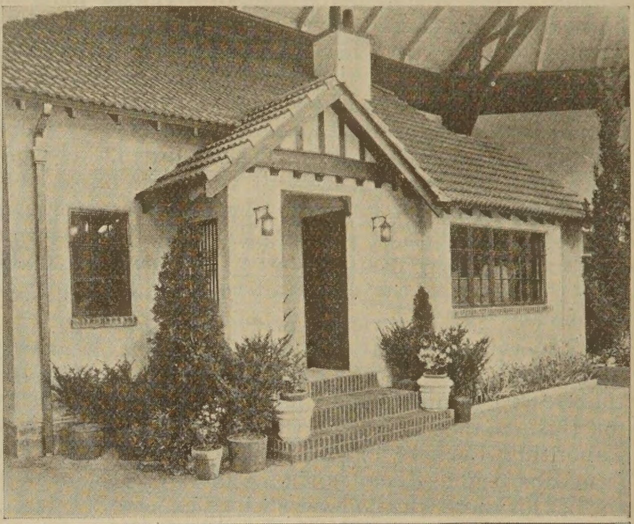


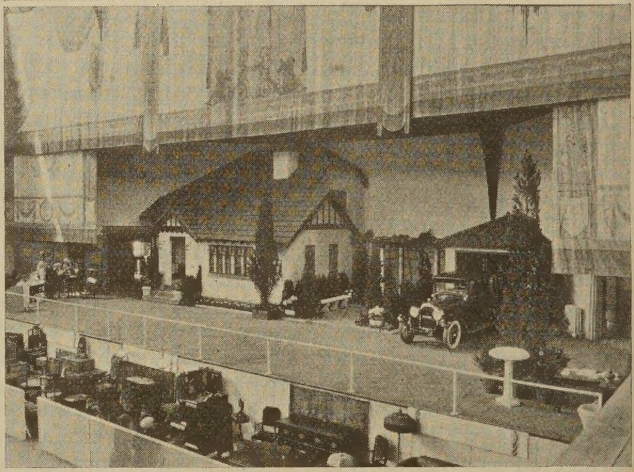
Spiral Roadway

Unique in construction is San Francisco's new spiral roadway in Lombard street, between Hyde and Leavenworth streets. It is paved between a winding concrete retaining wall between the property lines, against which an easy grade with banked turns is constructed. Part of the sidewalk space is used to make the turns wide enough. Previous to the construction of this spiral roadway the straightaway grade was 27 %, a death trap, but the spiral roadway is only 16 % grade which is not at all difficult if the driver doesn't get dizzy making the turns.

This is expected to be a demonstration to property owners in the residential sections on hillsides of the manner in which their streets can be made both beautiful and useful.

Boston Exposition Features Concrete House





The feature exhibit of the Home Beautiful Exposition held in Boston, April 23 to May 5, was a concrete house. Figuratively and literally, it occupied the center of the stage of the Grand Hall.

The exposition as a whole provided a remarkable example of the tremendous interest in home building and furnishing. Hundreds of attractive exhibits filled the fourteen acres of floor space at Mechanics Hall. The attendance exceeded even last year's record, when 275,000 people passed through the gates.

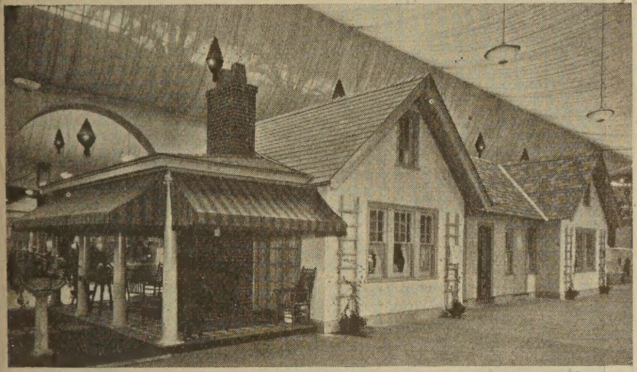
Credit for the development and elaboration of the concrete house exhibit is due to the Boston office of the Portland Cement Association. The services of a prominent local architect, Robert L. Stevenson, were enlisted in designing a six-room cottage of an unusually attractive plan. Effective cooperation with several local concrete operators and products manufacturers and with other local equipment concerns resulted in the erection and furnishing of the cottage in record time. Due to inability of the stage floor to sustain heavy loads, it was possible to erect only the front part of the cottage, but with the concrete paved courtyard, the adjacent garage from which an automobile emerged, and the effective landscaping, the whole was sufficiently definite to be convincing.

The solidity of concrete foundation blocks, the attractiveness of the stuccoed exterior, the fireproofness and permanence of the concrete tile roof, all contributed to the effectiveness.

The crowning event of the exposition was a public wedding which was solemnized on the stage on the steps of the concrete cottage. The hardy couple who braved the interested stares of thousands were the lucky recipients of a $500 cash gift from the management of the show, besides a carload of furniture and other home equipment contributed by the exhibitors.

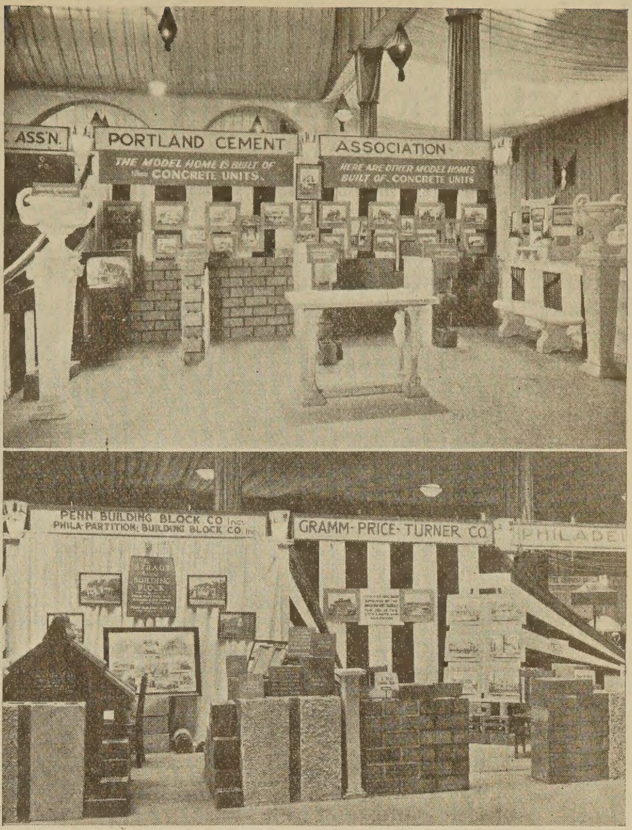
The roofs of the house and garage were covered with Waterseal Concrete Roof Tiles in a dull red shade that gave a touch of color to the buildings. Some of those cooperating in supplying the material for the house and garage included: Waterseal Concrete Roof Tiles, New England Concrete Products Co., Boston; block foundations of house, Eastern Block & Tile Co., Wellesley Hills, Mass.; blocks in garage, J. M. Simpson, Boston; floor tile, Chappisi Bros., Boston; stucco, Bernier & Sons, Cambridge, Mass.; tapestry brick, Waldo Brothers & Bond Co., Boston; garden furniture, S. Belanger & Son, Nashua, N. H.; bronze fountain pieces, T. F. McGann & Sons Co., Boston; steel casement, Lupton Steel Sash Co., Boston; doors, A. W. Hastings & Co., Boston; landscape gardening, Framingham Nurseries, Framingham, Mass.; lumber, William H. Harlow, Boston; hardware and electric lights, W. C. Vaughan Co., Boston.

Concrete House Materials in Philadelphia



It is not so very long since concrete building units were practically unknown in Philadelphia. Now there are enough manufacturers of concrete brick there (about a dozen) to have an association, with hundreds of thousands of these units being used—not to mention concrete block, especially cinder block, and light weight concrete building tile, which are used extensively.

At the Home Show in Philadelphia, May 14 to 26, a model house was shown by the Architectural and Building Division of the Philadelphia Palace of Progress. It was designed by D. K. Boyd, of Boyd, Abel and Gugert, an architect of national reputation, and built with walls of Blystone Try-wall tile, made by the Gramm, Price, Turner Co., Ashland, N. J., Straub patented cinder block made by the Penn Building Block Co., Philadelphia, and common concrete brick furnished by the Philadelphia Concrete Brick Manufacturers Association. The chimney was of concrete face brick made by the Quaker Brick Co., Philadelphia. All these units are used as a base for stucco in a variety of finishes. The wax covering is shared by Ambler asbestos-cement shingles, Johns-Manville rough texture Colorblende asbestos-cement shingles, Penn waterseal concrete tile and slate.


ASS'N.
PORTLAND CEMENT
ASSOCIATION
THE MODEL HOME IS BUILT OF CONCRETE UNITS
HERE ARE OTHER MODEL HOMES BUILT OF CONCRETE UNITS
PENN BUILDING BLOCK CO. Inc.
PHILA. PARTITION BUILDING BLOCK CO. Inc.
GRAMM-PRICE-TURNER CO.
PHILADEL
STRAUB BUILDING BLOCK

The Portland Cement Association booth featured various types of dwelling house construction, and booths of the Penn Building Block Co. and Gramm, Price, Turner Co. showed these companies' products.

20 Years of Progress

The next convention of the American Concrete Institute will be held in Chicago, February 25, 26, 27 and 28, 1924. As it will be the 20th convention—marking two decades of very wonderful progress in concrete work, "It is planned," says the Institute *News Letter* of May 23, "that it shall surpass all previous Institute meetings in several distinct respects, among them: (1) The practical applicability of its subject matter, (2) The timely nature of the work of committees, (3) The extent of the field of work covered.

This last will be increased by a decision of the Board of Direction to adopt a sectional meeting plan insofar as it is needed to get the closest attention to and freest discussion of special subjects—as for instance, for products manufacturers, building superintendents, reinforced concrete designers. Two meetings in progress at one time will make it possible to devote much more time to each part of the field, leave more vacant periods for inspection trips, and still preserve the unity of the organization for all matters of general interest such as the consideration of factors of good concrete and everything requiring action of the Institute as a whole.

Past President Henry C. Turner, president of the Turner Construction Co., has been named chairman of a Special Convention Program Committee. Mr. Turner with two other members of the Board of Direction, vice president M. M. Upson, of the Raymond Concrete Pile Co., and Edward D. Boyer, of the Atlas Portland Cement Co., will form the nucleus of the Committee to which other appointments will be made.

This committee will have charge of arrangements for certain special features which are planned to make the 20th Anniversary celebration really noteworthy.

It has been further decided by the Board of Direction that there will be arranged for the next Convention an exhibit of specimen concrete to include finished products, models, drawings and photographs which will effectively visualize the progress of 20 years in methods and in achievement. There will be no commercial exhibits as such; everything will be shown strictly under the auspices of the Institute, and there will be no exhibit space for sale.

Waterproofing Effect on Concrete Strength

By Duff A. Abrams
Professor in Charge, Structural Materials Research Laboratory, Lewis Institute, Chicago

At the recent meeting of the American Concrete Institute, considerable interest was shown in a discussion of the function of integral waterproofing compounds in concrete. We have recently made a series of tests to determine the effect of these compounds on the *strength* of concrete. The tests formed a part of a series of laboratory and field researches on concrete exposed to sulfate soils and waters.

Compression tests were made on 6- x 12-in. concrete cylinders, in which 11 different integral waterproofing compounds were used in 1:3, 1:4 and 1:5 concrete mixtures, with aggregate graded up to 1½ in. In a number of instances, 2 or 3 percentages of the compounds were used. The tests were made at the age of 28 days after curing the concrete in a moist room.

Without exception, the compressive strength of the concrete was reduced by these compounds. "Normal" concrete, that is without integral compounds, gave the following strengths: 1:5, 3010; 1:4, 3460; and 1:3, 4230 lbs. per sq. in.

A soap solution of ¼ lb. per gallon of mixing water gave a concrete strength 57% of normal; 5% crude oil (both asphaltic and paraffin base) gave concrete strengths 73% of normal.

Four different proprietary waterproofing compounds used in the percentages recommended by the manufacturers, gave concrete strengths 74 to 87% of normal, average about 80%. A so-called alkali-proofing compound (patented) gave concrete strength 16% of normal.

Little difference was found in the relative effect of integral compounds due to the quality of cement within the range of the mixes used in these tests.

We have made no tests on the value of these compounds for waterproofing, and at this time no conclusions can be given with reference to their effect in concrete exposed to sulfates. However, users of such compounds should consider that the strength and probably the resistance of the concrete to destructive agencies may be seriously reduced thereby.

The Progress Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, treated this phase of waterproofing concrete very briefly by saying that "Integral compounds shall not be used." This committee is composed of five representatives from each of five of the leading American engineering organizations which are interested in this field. Their report was published in 1921 by the American Society of Civil Engineers and by the American Society for Testing Materials.

Cement Protects Boilers

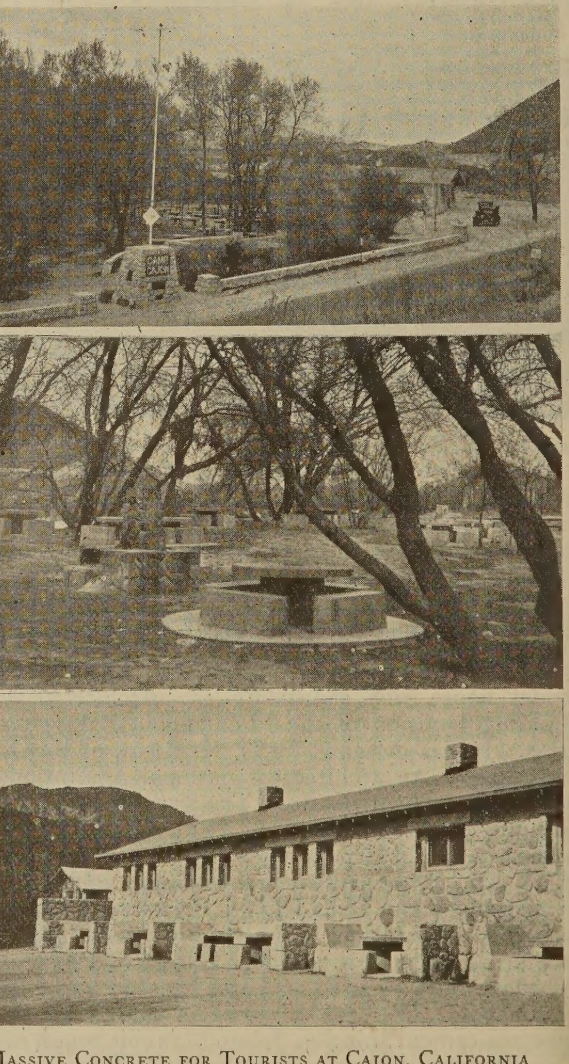
A portland cement wash of a thin consistency and applied with a paint brush has been used successfully for coating the inside of heating boilers to prevent pitting of the metal surface. All small blisters were removed so as to get to the solid metal, and after the surface was thoroughly cleaned with scapers and a wire brush, it was given two coats of a cement wash.

The use of this cement coating is also recommended for the inside of hot water storage tanks for office buildings, according to *Power Plant Engineering*. It is claimed that the painting with cement wash of all iron or steel water tanks will prevent the formation of rust.

A Warm Welcome for Tourists at Cajon

Communities all over the country are vying in their efforts to please the motoring public, and Cajon, California, is well to the fore with its splendidly equipped tourists camp. Located at one of the southern gateways to the state, with Los Angeles only a short distance to the west, it is on the path of thousands of motorists who come through every year. And Cajon finds it is worth while to cater to their comfort and convenience.

A feature of the Cajon camp ground is the solid and substantial character of the equipment, which is made almost entirely of concrete. The al fresco dining hall is equipped with circular concrete tables, the tops being six inches thick, and reinforced; the seats likewise are of similar massive construction. The out-door stoves are made of rubble concrete, with huge stones laid in cement mortar. In the rest rooms provided for the travelers, the same cyclopean scheme is carried out; it is also emphasized in the signs, road parapets, and other masonry construction surrounding the camp.



Massive Concrete for Tourists at Cajon, California

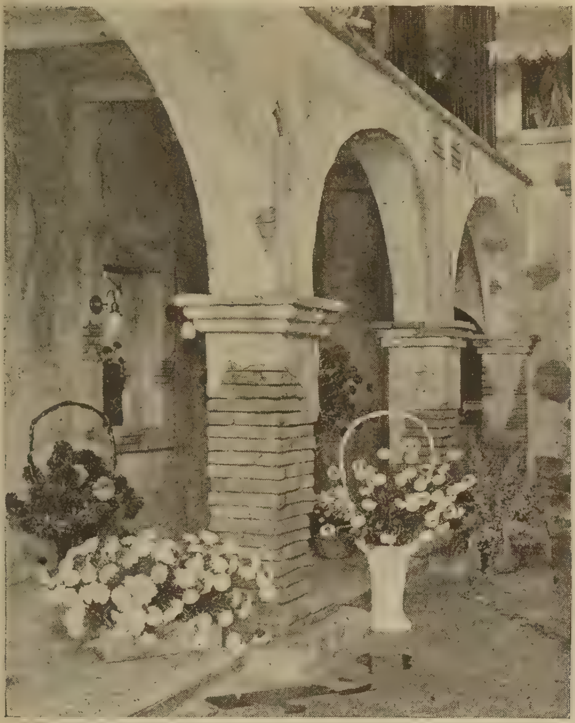


FIG. 1—(LEFT)—THE ARCHES AND TILE FLOOR; NOTE MIRROR IN WALL

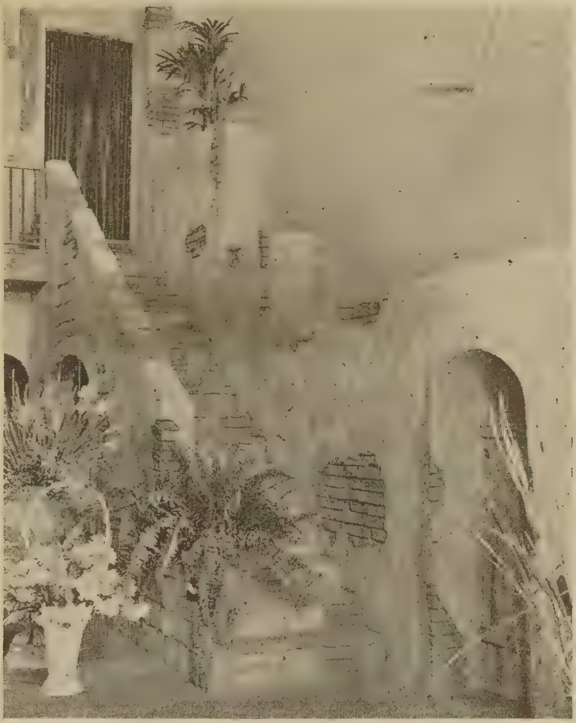


FIG. 2—(RIGHT)—CLOSE-UP OF THE STAIRWAY; DOOR AT BOTTOM IS OF CONCRETE

Unusual and Artistic Concrete Work

Realistic Fairy Cave and Old Mission Florist's Shop

The interior treatment and finish of stores, cafes, theatres, and sometimes parts of large residences give opportunity to simulate exterior effects to carry out the out-of-doors illusion. The unusual, done not in a bizarre manner but artistically and uniquely achieved, is becoming more and more popular. Sometimes the effect is obtained with brick or plaster marked out in stone blocks, with logs, or with tile eaves extending into the room. Great ingenuity is evidenced in occasional gardens and fanciful decorative creations based on legendary lore or vivid imagination. In all such work concrete is found a particularly tractable material, lending itself readily to many different results.

There is in Los Angeles a flower store with an appropriate interior decoration based on the Old Missions. F. Scotti, who is a specialist in artistic concrete work, planned and executed it. What Mr. Scotti has to say he says with concrete. He knows how to use this material for unique interior effects. His interest in the crumbling Missions of California took "concrete" form in this florist's shop copied from the San Fernando Mission and that of San Juan Capistrano.

The work was all done with concrete stuck to metal lath or wire work, on a frame work of iron rods where necessary. The arches and pillars were shaped in ½-in. iron rods with ¼-in. rods short distances apart, forming a network. Wirecloth was then fastened to this surface and plastered over. Cross-beams, roof-boards, doors, window sash, trimmings, all are imitations of the old wood construction of the Missions. The wood detail was worked into the finish coat while the plaster was yet soft. Grain lines were cut with wire forks, some with the trowel point—much as a painter works on wood. Knots were made with a circular tube of sheet metal, the larger ones with the trowel. Other detail was executed by pecking with a nail, sweeping the surface with a whisk broom, or marring with a knife. Characteristic of the old missions is the mortar peeling off and exposing patches of rude

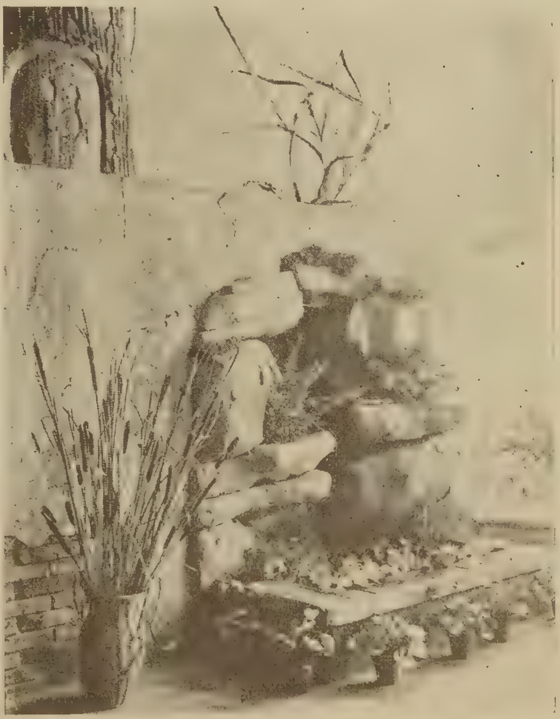
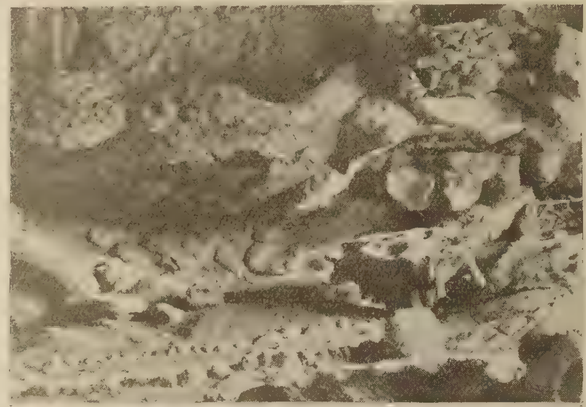


FIG. 3—THE ROCK FOUNTAIN



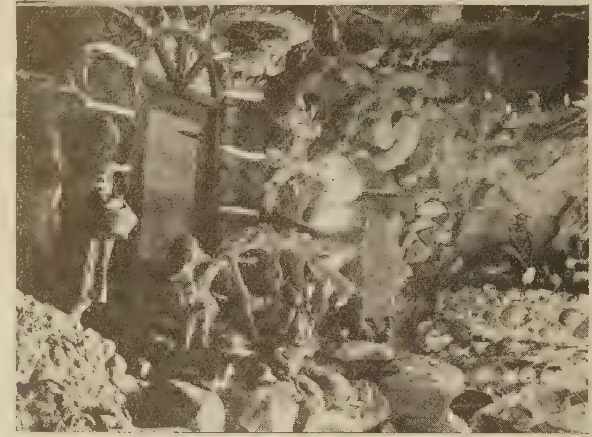


Fig. 4—(Top)—Molded Concrete
Fig. 5—(Bottom)—Red Riding Hood at Grandma's Door, Shell Fountain, Branch Work

brick. Mr. Scotti lined his brick in the second mortar coat, then applied smooth plaster and let it lap irregularly over the rough brick work.

Wood formed the base of the stairway; metal lath was fastened to this frame and plastered over. The steps are marked out to represent tile, similarly to the floor under the arches. Part of these surfaces were cut away with the trowel, to give a worn appearance.

Near the front of the shop is a small fountain, of rocks which were shaped out in a frame work of iron rods, wireclothed and plastered. Detail was worked into the second and final coats, and the pool bounding marked out to make tile like that of the floor and steps. A tree trunk, concealing a building pillar, appears to rise over the Mission wall.

All color was applied to the finished surface. The usual colors—black, red, yellow, brown—dissolved in water with a small percent of sulfate of iron as mordant, were used. The smooth wall was tinged only slightly, yellow and black. The brick, tile and wood imitations had all the color they would absorb—tile and brick, red, like real Mission tile; wood, brown and a weak black which gives a dull gray effect. The fountain rocks took all the colors.

The shop appears to be built of everything but concrete—peeling plaster, rude brick, natural rocks, old wood—while in reality it is entirely of concrete. Visitors are interested and amazed by the truth of this representation of the Old Missions.

Frankly in the realm of the imagination is the fairy cave on the Hollywood estate of Arthur Letts of Los Angeles. It was built by Mr. Hooper and is about 30 ft. x 50 ft. x 12 ft., with an additional 10-ft. x 20-ft. alcove. The bright spot in Fig. 5 marks the entrance from the main cavern to this alcove.

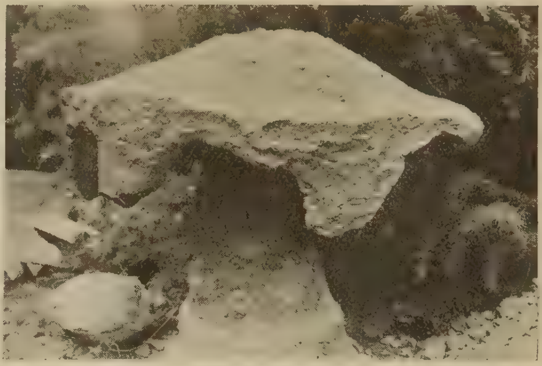


Fig. 6—Huge Mushroom Just Outside the Cave

Concrete walls and ceilings form the base work. Iron pegs set into the concrete face and metal lath wired fast made it possible to build ornaments. Stalactites and stalagmites were shaped out in wirecloth, 4 x 4 mesh, then plastered with a mixture of 1 part cement, 2 sand and some lime, the workmen using rubber gloves. Rustic branch work was done in the same way, built up and shaped with the hands from day to day. Ground sea-shell and ground granite, black and green, with bright stones and odd ornaments, were used in the second mortar coat. While this was still fresh, workmen threw onto it shovelfuls of additional granite and shell. Spots of green, queer bits of stone and shiny shell are scattered over the surface in delightful irregularity. Most of the wall rock, some parts of the ceiling, and the huge mushrooms were molded in sand molds outside. When overhanging ledge effects were desired, platforms were erected and the ledge poured; when the concrete set, the platforms were removed. Again, molds were partly filled with concrete, then a thick layer of sand added, then the remainder of the concrete poured; when it hardened, the sand was washed out and thus a ledge was obtained.

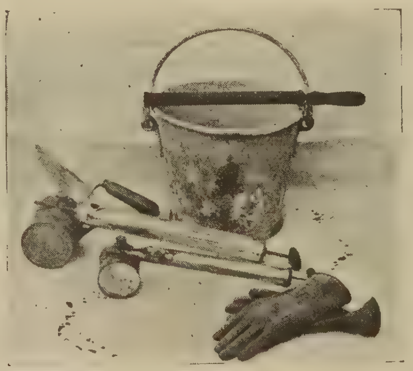


Fig. 7—Workmen's Tools

Concrete pieces molded in sand, together with the branch work, were colored after completion. Cobalt and other bright colors were sprayed on with garden sprays. When daylight filters in through the small windows, or the electric lights are on, the shade effects and the sparkling water of many little fountains bubbling from floor and wall are dazzling. There are some queer pieces of natural rock and many terra cotta figures of drawfs, birds and animals. A queer, misshapen fellow with a crooked stick watches with haunting eyes all who come into the cave; Puss-in-boots is there, Little Red Riding Hood, and all sorts of odd beasts. These rather remarkable figures were supplied by the Terra Cotta Art Co. of New York, and were imported from Europe.

How to Equip and Operate Local Gravel Pits

To Produce Concrete Aggregate[*]

By H. J. Kuelling
Construction Engineer, Wisconsin Highway Commission, Madison

Many people view the subject of local material with suspicion. This is especially true of contractors who are not desirous of being loaded down with any more equipment or any more troubles. In Wisconsin, however, the contractors are gradually coming to look with favor upon this method of producing material, and there will be an ever increasing competition upon jobs where local material is available.

In the opinion of the writer, the use or non-use of local material depends entirely on economy; in other words, the question is, which is the cheaper—local or shipped-in material. It is entirely out of the question for a state, county or local community to subsidize any commercial pit or quarry. The writer frankly admits that commercial pits and quarries can produce more cheaply than a temporary local plant and advises using them where the question of freight does not enter in and the difference in truck hauls is not too great. However, as soon as freight on a railway enters into the argument, the handicap of ninety cents to a dollar a yard enters, a sum which alone more than covers the average production cost of the Wisconsin local pits.

Instead of the commercial companies sitting back and criticizing, the writer believes there is a good business opportunity for a producer to go into local production with one or more small outfits, such as will be described below. Plenty of business could soon be worked up for such an enterprising producer, as many contractors with no experience in aggregate production would be only too glad to hitch up with him.

Some people criticize local material on the ground of quality. The good Lord doesn't change the sand and gravel if it is operated locally, rather than commercially. Properly operated, as many local pits are, just as good material is obtained in one case as the other. Assuming proper quality of sand and pebbles in the deposit, sufficient washing and separation of fine and coarse will produce satisfactory aggregates in either case. Improper operation will produce unsatisfactory material, as we all know who have had to reject material.

Local material may consist of the production of fine aggregate alone from a sand pit, the production of coarse aggregate alone from a local quarry, or the production of both fine and coarse aggregate from a gravel pit. The nature of the subject assigned to the writer naturally confines him to the latter method, although all three are in operation in Wisconsin.

In the past season in that state there were constructed 355 miles of concrete road. Of these, there were 187 mi. for which the fine aggregates were shipped in by rail; 84 mi. trucked or otherwise hauled directly from commercial plants; and 84 mi. produced in local operations. In percentages these run 52.8% shipped; 23.6% trucked from commercial plants, and 23.6% from local production.

In the matter of coarse aggregate there were 153 mi. on which they were shipped on railways; 119 mi. trucked from commercial plants, and 83 mi. produced in local operations. In percentages these are 43.1% shipped; 33.5% trucked from commercial plants, and 23.4% produced locally. Analyzing these on a basis of two coarse to one fine aggregate, it is readily seen that 54% of the tonnage on these 355 mi. of paving never saw a railway. Naturally this means cheaper concrete roads, a saving in freight, easing up on the burden of the railways, a saving in bond cost, and an easing up for the contractor in the all important matter of financing his job. A vast majority of communities have no such opportunities to save money, but others have and are sometimes passing by a good opportunity, as we did in more than one case.

Getting back to the subject, a question of equal importance with the equipping and operating is the locating and proper testing of sites. There is no doubt that much of the bad repute of local production can be traced to lack of knowledge before operations were begun. Then when the pit failed the whole question of local production was condemned.

Finding the Supply

In Wisconsin, we believe the matter of locating the gravel is the duty of a geologist, so all of our material parties are in charge of a geologist, just as they would be if we were to seek a deposit of lead or iron. His knowledge of geology shows him where to seek the best supplies. This fact has often been brought out in a startling manner in the finding of good pits where the local people insisted no material existed and where the average layman, or engineer even, would not suspect it. The duty of the engineer who accompanies the geologist in locating, is to study the deposit from the physical viewpoint and decide whether or not it can be successfully operated.

Each party is equipped with a Ford Ambulance of the type used in the World War. It is also fully equipped with shovels, picks, scales, containers, screens, glacial and soil maps, and any other tools necessary to conduct their work efficiently. Some of the parties carry along small cooking outfits, while practically all of them sleep in their cars at night. They are paid a salary and have to maintain themselves out of this. They turn in an expense account for the car, however. Each party is given a number of proposed projects to cover.

The methods of the parties vary, of course, with the kind of material for which they are searching. Those parties whose task it is to locate concrete aggregates have to spend more time and take more care in the results than do those which are locating surfacing materials.

A party locating aggregate for concrete construction must first try to find a satisfactory deposit as near as possible to the center of the project. If this is impossible, they must widen out in their search, always keeping in mind the disadvantages of long hauls and poor set-ups. They must also locate in each case the nearest water supply. They usually do some test pitting, especially on undeveloped deposits, to determine stripping and otherwise prove their conclusions. In general, a field test is made of the material in the nature of a silt, colorimetric and screen test. Notes are kept on loose leaf forms provided by the Highway Commission. The deposits are spotted by section, town and range, and the owners' names obtained wherever possible. Each deposit is given a location number, these numbers starting at one and running upward consecutively in each county; there are no duplicate numbers in any one county.

Such surveys cost the state in the neighborhood of forty or fifty dollars per mile of project. After the surveys are made and the field information properly analyzed it is up to the materials department and the district office to see that the most promising locations are properly test-pitted.

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[*] From paper read at the Annual Convention of the American Road Builders Association, Chicago, January 16-19, 1923.

The test pitting is an exceedingly important feature of the work. It must be done extensively and thoroughly. The methods involved and the extensiveness, of course, vary with the kind of material being searched for. If several miles of concrete road are to be built out of a proposed pit, it is necessary to very thoroughly test-pit the site, especially if it is an undeveloped deposit. Enough holes should be dug to determine the extent, and they should be dug to an adequate depth to determing the working face. We have dug holes thirty feet and over by using box sheeting of 2-in. boards 4 ft. long dovetailed at the ends. It is an easy matter to construct a windlass operated by hand, and with a hole 4 ft. square a pretty good sized bucket can be attached for raising the material out of the opening. The samples for testing purposes should be taken at the time of digging. Our requirement for such purposes is a representative sample of 500 lbs. of pit run material from the deposit. The samples should not be taken from one hole but from several different holes. Probably the best method of handling the samples is to sack the material in cement sacks. Tags are filled out and one placed inside the sack and one attached; the sacks are then sent express or freight, collect, to the laboratory at Madison. The man supervising the work also fills out an aggregate sheet furnished by the Commission describing the deposit, and this sheet he sends direct to the materials department. Here a duplicate is made and sent to the laboratory, the original being kept in the files.

From these samples tests are made, both on the fine aggregate and the coarse. Sand briquettes are made for breakage at three, seven and ten days. Coarse aggregate is tested in specimens 18 in. long, 8 in. wide and 4.3 in. thick. These are always made at the same time as specimens of standard material. Both are tested at the same time in a rattler and later in tension and compression. By always running these tests with a standard, we can compare the material not only with the standard, but with any other.

The information thus obtained is placed in the hands of prospective bidders through the medium of the district offices. The cost of testing material from one deposit is estimated to be about $35.00. If a prospective bidder is still not satisfied he may make an investigation of the material himself, and should by all means make a most careful investigation of all the physical features surrounding its use, such as water supply, topography, soil, roads, etc.

Of course, no proposed gravel pit can be guaranteed to be absolutely safe. By this, we mean that even with the best kind of test pitting, a few pits, when opened up, disclose objectionable features which were not apparent before. These features may be enumerated as a pit running to sand, too many oversize boulders, and a pit containing heavy seams of clay. These failures, however, are few and often where there has been a failure some bit of negligence or ignorance was responsible for it.

For instance, in one case the proposed deposit was thoroughly test-pitted, but in setting up the plant was moved just a little north along the ridge from where the test holes had been. When the ridge was opened huge boulders were encountered and the drag line had to be changed to a steam shovel. The boulders had not shown up in test pitting and, in fact, the south side of the pit, which was the side nearest the test holes, showed hardly a boulder. Another case was that of a deposit not recommended by the state, but one which the contractor was eager to set up in. Consequently, while a small pit was showing in a ridge it was never thoroughly test-pitted. The result was disastrous, as the contractor was ordered to shut down when it was found that the material was running out and also was becoming too dirty to use for concrete. Another case was that of a perfectly good pit, but one wherein inadequate machinery was placed. The contractor placed a small movable outfit in this pit to produce concrete aggregate. The bin capacity was only 18 yards. While the pit run material actually ran 50% sand and 50% stone, the plant was too small to handle the waste sand successfully, with the result that it was an absolute failure and was forced to quit right at the start.

The writer has gone into all this detail of the locating and testing of gravel pits to impress thoroughly the fact that local production requires considerable gray matter even before one should think of the equipment and operation.

PLANTS FOR GRAVEL PRODUCTION

The production of concrete aggregates by means of a local plant is a problem of some magnitude. In the first place, a plant for this purpose must be stationary. There is no such thing as an efficient portable plant for producing concrete aggregate. Another good feature of the successful plant is adequate bin capacity, for if there happens to be a temporary breakdown in the pit operating machinery and the bins are pretty well filled up, the trucks or other hauling equipment are still able to operate. Of course, the entire equipment must be efficient and efficiently operated as well. Too small a crusher or screens, not enough horse power, poor management, and a poor pump in case of washing, are some of the objectionable factors in a plant not operating efficiently. The contractor in choosing his set-up and machinery has quite a problem on his hands. He should look the proposed site over well and take all the factors into consideration. He must consider the distance he is to be from the project and also what method of hauling and mixer charging is to be used. Of course, the problem of set-up does not always rest with the contractor, as there are quite a number of cases where the county has owned and operated a pit, supplying material for its own day labor crew, or else furnishing material to a contractor at a much lower price than he could purchase it for from a commercial concern.

A well built and efficient gravel plant for producing satisfactory aggregates for concrete pavement construction should cost in the neighborhood of $10,000 to $12,000, including the items of erection. The reason for a variance between the above mentioned figures, is the difference in cost between a washing and dry screening plant, freight, erection, etc. A plant of this price has a bin capacity of about 200 yds., which ought to be sufficient. Below is a table showing the approximate cost of a stationary up-to-date gravel plant:

Crusher	$ 2800
Grizzly screen	50
Blade Feeder	300
Cables, sheaves, etc.	300
Hoist	1000
Drag line bucket	450
2 60-H.P. Motors	2200
Elevator	500
Screens	400
Lumber for bins, etc	1000
Cost of erection	1000
	$10000
Cost of washing equipment	700

Another item which is really an extra is the measuring device. Where batch trucks, for instance, are to be used this is an absolute necessity. There have been attempts to construct home-made devices, with mediocre success. There are mechanical devices on the market which are quite successful. They are, however, pretty expensive, as an outfit costs about $500.

Two plants of one contractor are identical, and while not absolute models of perfection are worthy of description:

> An arrow-shaped drag line bucket handling about a cubic yard at a time pulls the material up, where it is dumped through a trap onto the blade feeder. This feeder is in the form of an endless belt which has a number of blades fastened thereon. This turns slowly and constantly dumps the material onto the grizzly screen. Thus the material is fed gradually to the crusher while the drag line is making its return trip. The rejected gravel from the grizzly drops into a No. 4 gyratory crusher set at about an inch and a half. Then the material is carried up to the screens in a bucket elevator about 50 ft. high and containing approximately 140 buckets. The screens are of the revolving type, 4 ft. in diameter and in sections. The first section is 6 ft. with a ¼-in. round opening; the second, 4 ft. with a ¼-in. round opening, and the third, 6 ft. with elliptical opening ¼ in. x 1 in. in size. For dry screening, a screen of the last section type is probably the best. However, the last section of screen should have 2-in. round openings to take care of any oversize material. A chute could be built from the end of this screen back to the crusher. It has also been found very necessary at times to insert a section of ½-in. round screen to waste the pea gravel sizes when the gravel in the deposit runs fine. Two 60-H.P. motors furnish the power for operating this plant. One takes care of the blade feeder, crusher, elevator and screens, and the other the double drum hoist operating the drag line.
>
> The bins for this plant are 11 ft. wide, 36 ft. long, and 14 ft. deep. They are set on a concrete foundation 38 ft. long with a 3-ft. base tapering to 16 in. The horizontal timbers resting on this concrete foundation and supporting the uprights are 10 x 12s. The uprights themselves are 10 x 10s and 12 x 12s. Seven 10 x 12 timbers are used as braces for the uprights. There are also fourteen cross braces 6 in. x 8 in. in size, seven on each side. Two x 12s are used as floor joists on 6-in. centers. There is also cross bracing on the side of 3 x 12s; two are used together, making six pairs on each side. The floor and sides of the bins are of 2 x 12 planks, the studding being the same size as the floor joists. They are double rodded, the long rods being 1½ in. in diameter and the short ones 1⅛ in. The bin supports or whales through which the rods are bolted are 6 x 12s doubled. These hold the whole bin together and there are three tiers of them: the first, 1 ft. above the sill; the second, 4 ft., and the third, 10 ft.

WASHING EQUIPMENT

A large proportion of local pits contains enough dirty material to require washing. There is also something in the proposition of expediting the work of the screens by washing, especially on damp days. A number of different types of washers are used. Probably the most common is that of old tilting box type, with which nearly every one is familiar. The valve control or discharge for the washed sand in this type is dependent of operation upon the weight of the sand contained in the settling tank. There are a few mechanical objections to a washer such as this. First, the inertia of so great a weight makes the valve action slow, so that with uneven feeds the valve does not always close in time to prevent a "runaway." Secondly, a tank of this sort is operated by balanced weights which, to operate quickly, must be set so that the valve does not close tightly when the feed of sand ceases but while the water is still coming. Sometimes, unless the valve is closed by hand, an amount of water and clay gets into the clean sand already discharged.

There are also steel conical tanks on the market which are quite expensive, but more efficient as the discharge is controlled by volume rather than by weight.

A good many pit operators are using a washer of a different type. This is really a mechanical conveyor sort of settling tank. It consists of a large rectangular wash box of wood, with a discharge for clay and dirty water at one end. The floor of this box slopes upward at the other end to the top. A number of blades are fastened to an endless chain which operates over sprocket gears at either end of the box. These blades dip down into the water, and by close contact with the slanting floor carry the washed sand to the top where it is dumped over into the bins. There is a space at either end of each blade, which permits excess water to return to the tank. These blades continually agitate the dirty water in the tank and keep the dirt in suspension until it is carried off over the spillway. Plenty of clean water must be poured into the tank continually, and it is well to have several sprinklers playing on material as it is pulled up to be dumped into the bins. These washers are sold in two sizes, 4 ft. x 18 ft. and 3 ft. x 18 ft., respectively, and are priced at about $500, exclusive of any wash box lumber. The former size has a capacity of 40 tons of sand per hour and the latter 35 tons.

Any of these washers is, of course, for sand only. It is sometimes and, in fact, always, just as necessary to cleanse the gravel. For this, a water pipe with an end spray can be discharged into the screens. This will aid very materially in pushing the sand through the sand screen into the settling tank, and also in separating the sand from the stone, when it has a tendency to stick together in damp weather. It is also advantageous to have a section of closed screen containing angle irons bolted to the sides, which may be termed a scrubbing chamber. One of the principal requisites for a successful washing plant is plenty of clean water. Four-in. pipe should be used, if possible, and a pump powerful enough and a water supply adequate to produce 250 to 300 gal. per minute, are necessary.

COSTS

From one pit about 6.53 mi. were built. The total job was 7.29 mi. in length or 77176.4 sq. yds. of paving. The low bid on this was $1.07 per sq. yd., exclusive of cement, as against the lowest price bid for commercial material of between $1.12 and $1.16. This is a difference of about 7c per sq. yd. or a total saving of $5402.35 on the entire job. However, the facts that the pit was easily obtainable and a good set-up, that the hauls were good, and that several contractors were interested who wished to go into their own material production, all had a tendency toward producing one of the lowest bids per square yard in the whole state.

Another job consisted of about 8 mi. of 18-ft. paving, the low bid being $1.19 per sq. yd., and the lowest bid per sq. yd. using commercial material was $1.49 or a saving of 30c per sq. yd. This meant a saving of approximately $25,344 on this one job. The plant was equipped with a hoist and upright boiler, arrow scraper, one 60-H. P. motor, a loader elevator, a bucket elevator, old style washing plant, screens and 160-yd. capacity bins. Provision was made to shoot the rejected oversize stone back into the pit. From this plant approximately 25,400 cu. yds. of sand and gravel were hauled out on the road. This meant an average of about 250 yds. a day on the road and does not include an average of about 20 to 25 yds. of material wasted each day. Material was hauled in trucks onto the road and stock piled every thousand feet. From the stockpiles a fleet of Ford batch trucks carried the aggregate to the mixer.

Another road was constructed, 3.3 mi. in length, the low bid being $1.29 per sq. yd., using local material. The lowest price bid per sq. yd. using commercial material was $1.45, a saving of 16c per sq. yd. This means a saving of $5575.68 on the entire job. The material was trucked onto the roadbed, stockpiled and wheel barrows used to charge the mixer. This was the second season that the contractor had operated this pit.

Another job of 4 mi. was partly constructed, about 3½ mi. being built. The bid per sq. yd. using local material was $1.11, whereas the lowest bid per yd.

using commercial material was $1.35, or a saving of 24c a sq. yd. This is a saving of $10,137.60 for the entire job. The material was hauled on the road, stockpiled, and wheelbarrows used to charge the mixer. They had about 6000 yds. of material stockpiled on the subgrade before the actual paving work started. The equipment at the pit consisted of a bottomless drag line bucket, a plate feeder, a conveyor, a 9-in. x 15-in. jaw crusher, grizzly, a 36-ft. bucket elevator, a tilting box type washer, screens and bins, a 60-H. P. tractor, a double drum hoist and upright boiler, a 10-20 tractor, and a centrifugal pump. The bin capacity was small, holding only 90 to 100 cu. yds. Provision was made to shoot the oversize stone back to the crusher. The 10-20 tractor furnished power for the pump which had a capacity of 450 gal. per minute, but only about 300 gal. per minute were actually used. The production of this plant was small, as it averaged only about 150 cu. yds. of sand and stone to the road per day. The smallness of the crusher was greatly to blame for this since the 9-in. x 15-in. jaw crusher was only capable of a capacity of about 10 to 15 cu. yds. an hour. What they should have had in its place was a gyratory crusher No. 3 or 4 in size. The bin capacity was small and the whole plant was not constructed in as stable a manner as possible, probably accounting for the numerous delays and breakdowns. It seems true also from various observations that a scraper of the arrow type will handle a larger amount of material than the bottomless bucket.

One county operated two local plants. One contractor built about 40,634 sq. yds. using material from one of the county pits. His price for this, of $1.16 per sq. yd., was based on material at $1.00 per cu. yd. in trucks at the pit. This material, had he shipped it in, would have cost him $2.18 per cu. yd. for gravel and $1.90 per cu. yd. for sand in trucks at the destination. The comparative hauls were about the same.

The other county pit kept two pavers going and about 8 mi. of road were built using this material. It is rather difficult to get at the saving involved here as the contractor's bid did not include a material price, this being furnished him by the county. The county highway commissioner, however, believes that material was being produced in stock piles for about 70c a yd. Shipped-in sand and stone would have cost $2.03 and $2.20 per yd., respectively, unloaded in stock piles or bins. As in the neighborhood of 26,000 cu. yds. of sand and stone were used in building the road, it will be seen that considerable saving was involved (at least $30,000) by developing a local pit.

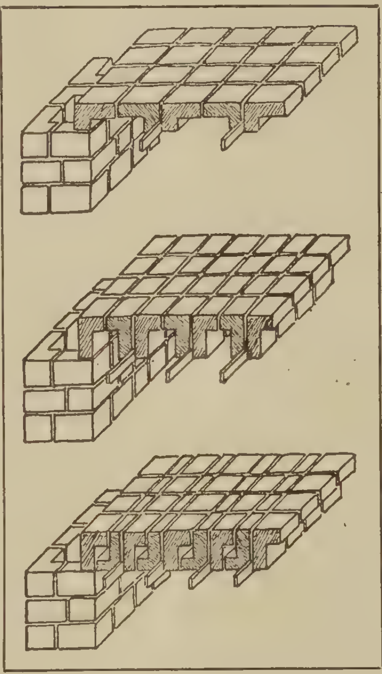
Both of these county plants used wash boxes. Each plant was equipped with a stiff-leg derrick and bucket. The material as it came from the screens was loaded into a large stock pile. From here it was transferred into the big measuring hoppers and loaded into batch trucks.

It will be noted in most of the cases cited above that competitive bids were asked on local and commercial materials. This was done on practically all the early jobs in order to have figures for comparison. The longer in advance the preliminary information is obtained, the better—provided, of course, that the locations are properly protected by options so that no individual can corner the supply. The contractor or county which is to operate the pit should determine the output desired, the amount of crushing likely to be required, and the amount of water needed before designing the equipment to be installed.

While the production of local materials may add somewhat to a contractor's troubles, it also has its redeeming features. He ceases to worry about gondolas, freight trains, train crews, paying for water in sand and gravel, demurrage, and kindred other pleasant things. He has his work more concentrated and can handle his paving crew more efficiently, as he knows more accurately the delivery of aggregates than is possible when dependent upon a railway.

In conclusion, the writer fully realizes that the use of local materials is a highly localized matter, but he also believes that where local material exists, the subject is deserving of the very best engineering and contracting talent that can be given it. With us, it has not only been the question of money savings. We have been enabled to do work which could not otherwise be done, as the use of local materials has relieved the railroads of business which they could not have taken care of and left equipment free for those jobs which absolutely had to be handled by rail.

Angle Tiles for Concrete Blocks



Tonindustrie Zeitung (Dec. 30, 1922) describes an angle tile which profitably might be manufactured in concrete, and used with reinforcements as indicated in the accompanying illustration.

Fig. 1 shows the use of these angle tiles for light, average and heavy loads. Two and one-half story buildings have been built with angle tiles making a 10-in. wall and carrying satisfactorily first and second floors loads as well as roof.

Must Concrete Chimney Be Lined?

Tonindustrie Zeitung

After both good and bad results from concrete chimneys in America, systematic construction of concrete chimneys was started in Germany during 1909 and 1910 and with generally satisfactory results.

The construction has largely been executed by specialists, and the consensus of opinion seems to be that for certain acidulous gases and above certain temperatures of the products of combustion, a lining is advisable.

Christoph Herrmann and Son, Mannheim, the most prominent chimney builders, express the following opinions:

> According to our experience reinforced concrete chimneys carrying off gases of 350° C., acrid or pungent, should be lined with brick to the top. For 400° C. the lower part should have fire brick and for 600° C., the entire height should be lined with fire and acid proof brick.
>
> For common steam boiler plants, where the temperatures do not exceed 200° C., ½ to ⅔ of the height should be lined with common brick. We have so far built 61 chimneys in reinforced concrete, and not a single crack has appeared in any one of them.

FIGS. 1 AND 2 (LEFT)—ROOF OF PERGOLA, LOOKING INTO GARDEN COURTS. (RIGHT)—ENTRANCE TO SOCIAL GROUP

Tokyo's New Hotel Unique Structure[1]

The Imperial Hotel, Tokyo, Japan, is outstanding in its beauty, permanence and serviceability of structure, and interpretive embodiment of a people's ideals. It is a building 300 ft. x 500 ft. on the ground, covering 150,000 sq. ft., or nearly two and one-half times the area of the great Auditorium Building in Chicago. The structure is three stories high in the main, with special masses equivalent in height to seven stories. Not one single form is distinctly Japanese, but the entire architectural whole is a beautiful epitome of Japanese thought and life and world-old vision.

Two types of service are attained: complete hotel accommodations and entertainment for the public and clearing-house service for the social obligations and formalities of Japanese official life. Continuity, accessibility and oneness are never sacrificed, however. The terrace idea is the key to the development of the plan in its entirety, with two great parallel wings guarding the inner courts and connected with the introductory group, formal social group, and vertical service sections.

The general construction of the building is definitely based upon the reinforced-concrete-slab idea, carried out theoretically and practically to its limits. Its specific application has to do with a flexible resistance to earthquakes—developing shocks, undulations, oscillations and twists, in action.

The entire structure rests upon a layer of spongy soil, beneath which is found mud of undetermined depth. Short concrete piles are inserted in the upper layer, where required and as numerous as required, capped by reinforced concrete slabs which receive their direct loads at calculated points. The entire structure thus rests upon a flexible foundation which is free to yield to the mutations of earthquake disturbance and come back to place again.

By a system of distribution of steel rods everywhere the masonry superstructure is knitted thoroughly together in such wise as to render it yielding but resilient. The slabs are as tenaciously yet flexibly adjusted to the vertical supports, and, where occasion requires, the slab system merges from the concept of lintel into that of cantilever. There is here so general a use of this latter method, on account of its adaptability to projecting horizontal slabs otherwise unsupported and the resulting ease of creating unobstructed areas, that it may perhaps be described as in essence a reinforced-cantilever-slab-system.

In the construction of all outer walls wooden forms were dispensed with; the outer layer of specially notched bricks, and the inside layer of hollow bricks, serving as forms. In the cavity between, rods, vertical and horizontal, were placed, and then the concrete filler, the wall thus becoming a solid mass of varied materials, into which the floor slabs are so solidly tied

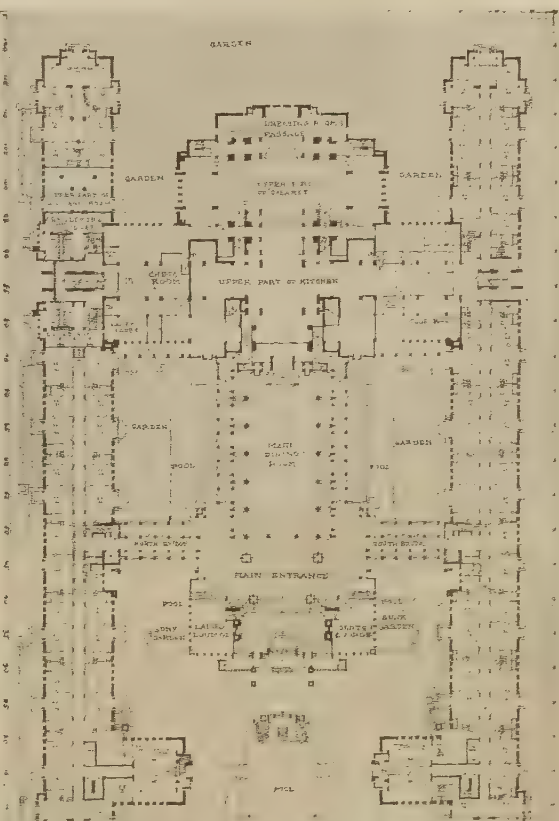


FIG. 3—GROUND FLOOR PLAN

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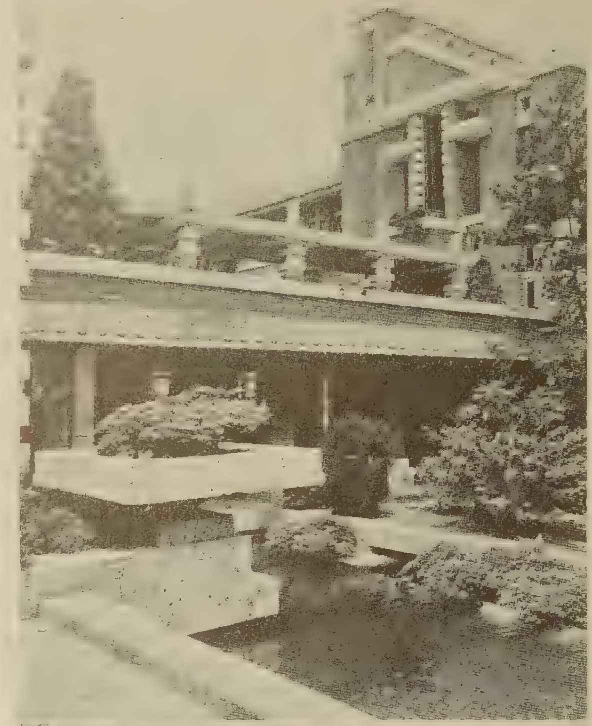
[1] Extracted from article by Louis H. Sullivan in April, 1923, issue of *The Architectural Record*.



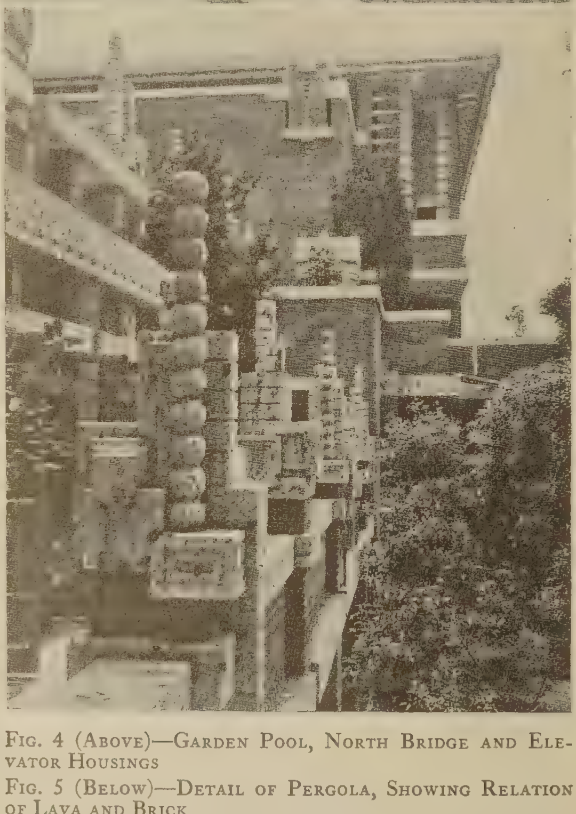


Fig. 4 (Above)—Garden Pool, North Bridge and Elevator Housings

Fig. 5 (Below)—Detail of Pergola, Showing Relation of Lava and Brick

as to take on the character of cantilevers, as conditions of disturbance might demand.

The structure is therefore almost literally *handmade*, so solidly built of materials inseparably united as to possess all the virtues of a monolith, and yet so completely threaded through with steel fibres as to add the virtues of elasticity and resilience. The Japanese workmen were most thorough and painstaking.

Built for resistance to earthquakes, the building was put to the test while nearing completion in April, 1922, in broad daylight, during the heaviest temblor in point of severity Japan has known in fifty years. Wide destruction was wrought in Tokyo. The shock was terrific. The Imperial was violently jolted. It visibly swayed and rocked in the upheaval, and at its ending quietly steadied to position, free of distortion, rents or damage of any kind.

A notable selection of local materials was adopted for the external effects: hand-made brick and hewn lava are chiefly used with a most interesting interspersion of copper for the cornices and delicately worked copper roofs. All flat roofs are of concrete and are treated as gardens.

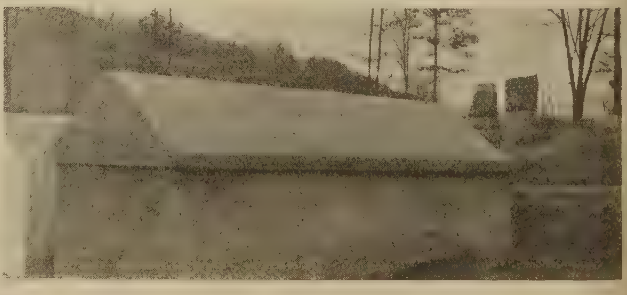
The color effect is quiet, yet piquant. The bricks are buff, the lava greenish yellow with deep brown spots, the copper turquoise. Minor color effects are secured in various materials, while to all these effects appertains the added charm of gardens and distributed flowers and shrubs.

As to the interior, a noteworthy feature is the use of lava and brick in the grand promenade, the theatre, the restaurant and the banquet hall. It was a happy thought to penetrate the interior with materials of the exterior, thus giving a sense of enduring construction. The main corridors of the guest wings are six feet wide, exposing the brick-faced concrete piers that support the floor, giving to the whole the effect of a cloistered promenade. The corridors are artifically lighted through perforated metal screens set into the ceiling. The floors are cork-tiled. The threshold has everywhere been eliminated. Where plaster has been used, the walls are treated with ground pearl shell splashed on to a heavy coat of paint in the Japanese manner.

The architect of the Imperial Hotel is Frank Lloyd Wright, and this building stands as one of the finest of its kind—unexcelled in construction, artistic conception, and complete satisfaction of all human needs.

Grave Covers of Concrete

In the mountains of southern and eastern West Virginia, Kentucky and Tennessee, it has long been the custom of the mountaineers to bury relatives on knobs or points overlooking the trails. On top of these graves have been placed wooden protectors about 2 ft. high, 2½ ft. wide and 7 ft. long. This was done, no doubt, to prevent the digging into the graves by animals and to prevent the sinking of the sod caused by rain action on newly made graves. Some of these have been left unpainted, others are bright yellow, green, red and blue. The accompanying illustration shows a different method, using a more permanent material, concrete, which affords the same protection and gives a lasting monument.



Grave Covers of Concrete

Cement Standards

The Voluntary Setting-Up of Quality Standards in Commodity Production[1]

BY F. W. KELLEY
PRESIDENT PORTLAND CEMENT ASSOCIATION

Quality and quantity standards are essential for the free interchange of commodities in commerce beyond the stage of first hand transactions in which personal observation and opinion govern. Progress in civilization is measured by commerce, so standards are at the base of civilization as well as of commerce.

Standards of time, space, weight, value and conduct are as old as history. They are so much a part of the environment into which each generation is born that there is no conscious recognition of a period when they did not exist, any more than in the case of the air we breathe. But all these standards had to be determined and established. Probably the first generally recognized minimum quality standard was that of conduct.

Every thinking man must recognize the necessity for standards and the desirability of providing recognized quality standards in almost every line of industry. There are in each industry, however, the practical questions—what should the standards be; how should they be determined; how can their acceptance be best accomplished?

There are at least 20 industries in which nation-wide quality standardization has been undertaken to a greater or less degree. The one with which I am most familiar is the portland cement industry in which a quality standard for cement accepted throughout the United States was voluntarily established through the cooperation of a large number of public and private engineering and technical organizations concerned with the use of cement.

Each industry has its special conditions and special problems but I believe the same principles apply to quality standardization in all industries, and that properly worked out, favorable results in them all will follow. The experience of the portland cement industry may therefore be useful to other industries, and a few facts will show why a nation-wide standard was essential, and will make clear how it was established.

PORTLAND CEMENT INDUSTRY

Portland cement, as is well known, is a powder which when mixed with water and sand, broken stone, or other aggregates, gradually hardens and binds the mass together in a solid stone known as concrete.

Portland cement was discovered and patented in England ninety-nine years ago. Its manufacture was carried on principally in England, France and Germany until about 1872 when its production was begun in a small way in the United States. The average annual production in the United States in the '70s was about 9000 barrels. It had grown to a little over a half million barrels in 1892; to about 17,000,000 barrels in 1902; and to nearly 115,000,000 barrels in 1922. Estimates just made public by the U. S. Geological Survey give the estimated productive capacity of the United States as 146,500,000 barrels annually.

The manufacture of cement is an exact chemical-mechanical process in which natural raw materials are ground and mixed; combined at a white heat to form a new artificial material called clinker, which is again ground to a finished product. The process is exactly controlled technically; uses large quantities of fuel and power; has large plant investment and slow capital turnover. Manufacturers must rely upon a large volume of business to make profits on this heavy commodity which is of limited shipping radius, and which sells at a pound price lower than that of any other highly manufactured article.

Portland cement when completely manufactured and ready for the consumer, is in its relation of usefulness to the community, a means and not an end. Its useful end is that of an essential ingredient in making concrete.

Concrete has a wide use because of its adaptability, of the ease with which it can be handled and formed into manifold structures, and of its qualities of permanence, fireproofness, and artistic appearance.

Cement, unlike many commodities, is not consumed. A concrete structure properly made has a permanent asset value. Full realization of this asset value, continued demand for cement, and the prosperity of the industry, depend upon right quality cement and right quality concrete.

Anybody anywhere may attempt to make concrete and the results reflect for all time the materials and methods used in the first few hours of its history. It is essential to all interests that the user of cement make good concrete.

FACTORS IN CEMENT INDUSTRY

The work of the Portland Cement Association, organized in 1902, which is a recognition of this mutuality of interest between cement user and manufacturer, is so closely bound up in the development of the industry that it must be here mentioned.

The Portland Cement Association is a national organization of cement manufacturers whose aim is to increase the knowledge, utility, and use of portland cement through scientific investigation, public education and national promotion.

It "sells" the use of cement, but not the commodity. Hence it is not concerned with prices nor other trading relations between its members and their customers.

It performs only such functions as cannot as well if at all be performed by its members individually.

It undertakes only such activities as are for the common good and the benefits of which, when utilized, flow alike to all contributing members.

Its conduct is jealously guarded and made to scrupulously conform in all respects to a high conception of commercial morality and a strict interpretation of the law.

It is much concerned with the quality of cement marketed by its members, since a poor quality cement furnished by any member would reflect upon the industry, decrease the use of cement, and hence injure every member.

The association has been especially concerned not only with right quality cement, but with learning how to use cement right and with making this information universally known. It maintains a research laboratory and field forces for these special purposes. When it is realized that an apparently simple matter like the quantity of water used in mixing concrete may make the difference between good and bad results, the need for this service work may be appreciated.

Mention should also be made of the American Society for Testing Materials, organized in 1902 "for the Promotion of Knowledge of the Materials of Engineering and the Standardization of Specifications and the Methods of Testing."

Its members are both producers and consumers familiar with the matters covered. Specifications are formulated and adopted under carefully prepared rules of procedure insuring to the highest degree sound, unbiased results.

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[1] Read before the Fabricated Production Group, U. S. Chamber of Commerce, New York, May 8, 1923.

Important factors in the situation are the Bureau of Standards of the U. S. Department of Commerce, with its group of trained experts and extensive laboratory equipment, and the several Engineering Societies to be hereafter mentioned.

Development of Specifications

With this background of conditions and factors affecting the industry we can now more intelligently trace the development of quality standards for cement.

In the early years when the industry in this country was small, its quality standards were imported. As the industry developed, the American Society of Civil Engineers undertook to formulate a uniform method of tests for cement, and from 1885 to 1903 this was considered the most reliable guide to a proper method of procedure.

In this period, many engineers and architects seemed to feel, perhaps to avoid reflection upon their professional skill and progressiveness, that it was necessary to add to an old cement specification some new requirement on each new job. A compilation of 91 cement specifications made in 1898 by Robert W. Lesley who later became first president of the Portland Cement Association, showed that scarcely two were alike. In many cases, the specification requirements were contradictory, and if strictly followed, would sometimes impair the quality of the cement. The result was unnecessary cost and endless annoyance, confusion, delay and difficulty for the consumer and manufacturer alike. A standard specification was becoming a necessity.

The American Society for Testing Materials took the lead in supplementing the investigations of the American Society of Civil Engineers, and in 1904 the first American Society for Testing Materials specification for cement was adopted. The American Railway Engineering Association, American Institute of Architects, the United States Bureau of Standards, the U. S. Government Engineers, and the Portland Cement Association, as well as the American Society for Testing Materials and the American Society of Civil Engineers, continued to study and to modify cement specifications and methods of tests sometimes within their respective organizations and sometimes through joint committees.

The method of the American Society for Testing Materials was unique in that its committee on Cement Specifications represented engineers, architects and other consumers who were always a majority, as well as producers, who were always a minority. This brought to bear upon the specification requirements a knowledge not only of the needs but also of the possibilities. Specifications made under these conditions are much more apt to be well balanced and useful than if made from one point of view only.

Adoption of Specifications

The final revision of the cement specification was unique, also, because its requirements were subjected to the most careful laboratory research and checked with experience in the field. The substitution of the facts of research for unsupported opinion, had its logical effect in reconciling views of men with engineering training. A single standard cement specification became an accomplished fact and was recognized by all established organizations in the United States in 1921. This was adopted on March 31, 1922, by the American Engineering Standards Committee as its Specification Number One.

As the Standard Cement Specifications were developed, much work was required to secure their general use. Engineers who for 20 years had been active in the engineering societies which formulated and later adopted the specifications, readily accepted them. Others not as familiar with the progress made, continued to use their own specifications until the mass of data and authority back of the standard specification was brought to their attention, when they generally were glad to join in establishing a single standard, the advantage of which they at once recognized.

Neither did all producers at once take up the specifications as developed. In the early days of the industry, blended and adulterated cements were sold under many brands. Membership in the Portland Cement Association was later open only to those making true portland cement.

Producers in some cases were reluctant to give up making cement to conform to certain special specifications because of a supposed advantage in marketing thus obtained by them.

The research work and tests made in establishing the standard specifications showed, however, that the existing variations from the standard were without economic value to the consumer. The general adoption of the standard specification by the engineer and consumer decreased the demand for cement made to special specifications, but it should be accounted a credit to these producers that they were willing to cut out the "bunk" so frequently used in selling, and provided a product having known and tried qualities and value.

On June 28, 1922, the Portland Cement Association, representing a large part of the manufacturers of portland cement in the United States, adopted a By-law making membership in the Association contingent upon members' product meeting the requirements of the standard specification.

Features of Specifications

At the present time, the standard specification for cement is almost universally used in this country. Thus we now have a nation-wide quality standard for portland cement, voluntarily accepted by both consumers and producers. It is the highest standard for cement in the world and has had an important effect in promoting, extending and improving the use of concrete in this country.

When compared with earlier specifications it is particularly noticeable that the fineness of cement is now measured with a sieve having 40,000 openings per square inch, a weave so fine it will hold water, instead of with relatively coarse sieves which have now been discarded.

The strength requirements are nearly double those of early specifications and are determined by improved methods.

The Standard Cement Specifications establish in most essential particulars minimum requirements, thus encouraging improvement. A quality standard must be responsive to changes demanded by new conditions in use or in production.

The Cement Committee of the American Society for Testing Materials is charged with the duty of studying proposed improvements in the cement specifications. Each suggestion is carefully tested and weighed, for in a material of such fundamental importance there must be certainty that changes are improvements. Laboratory practice has now reached a point where it is possible to determine this with a high degree of accuracy and laboratory results can always be supplemented by field tests.

Advantages of Single Standard

The working out of this situation and establishment of a single standard quality specification for cement has had, and must continue to have, many advantages for consumers, producers and the community as a whole.

The engineer and designer can rely upon getting anywhere the standard quality cement contemplated by the plans.

Concrete can be designed of definite strength and quality.

Simple rules have been made by which even the inexperienced can with care get good concrete.

Greater efficiency in production and lower cost have been made possible through continuous operation on a standard product.

A standard product can always be kept in stock ready for use.

A standard product is more readily accepted in export trade.

Wider production of cement has been made possible by eliminating unnecessary limitations on raw materials. In 1922 cement was produced in 118 plants in 27 states, compared with 65 plants in 19 states in 1902.

Nearness of production to markets has followed wider production. When it is known that the freight charges on a barrel of cement for an average 100 mile haul, are about 30% of the average mill price per barrel for the last three years reported by the U. S. Geological Survey, the importance of this will be appreciated.

Each standard established makes easier the establishment of other standards. The establishment of the cement specification makes easier the establishment of a specification for concrete. In the concrete specification now in process of formation, the cement specification and specifications for twelve other materials or methods entering into the making of concrete, are included.

Better and cheaper concrete structures are the net result.

CONCLUSION

The Bureau of Standards deserves the very highest credit for the sturdy support and valuable assistance it has given to all cement standardization work. The industries of this country will do well to become familiar with and utilize its facilities and knowledge readily placed at their disposal. The opportunity offered by the American Society for Testing Materials for cooperative work on specifications within its field, is worthy of attention.

Industries which have not already established standards may well consider carefully the advantages of determining standard specification requirements through voluntary action by consumers and producers, rather than wait for a specification determined by some outside authority to be imposed upon them.

The principle underlying this standardization is that underlying all progress—the movement from the indefinite to the definite. The trend is certain. To voluntarily accelerate progress in the direction it will inevitably take, is the part of wisdom.

A "Daylight" Building for Yarn Mill

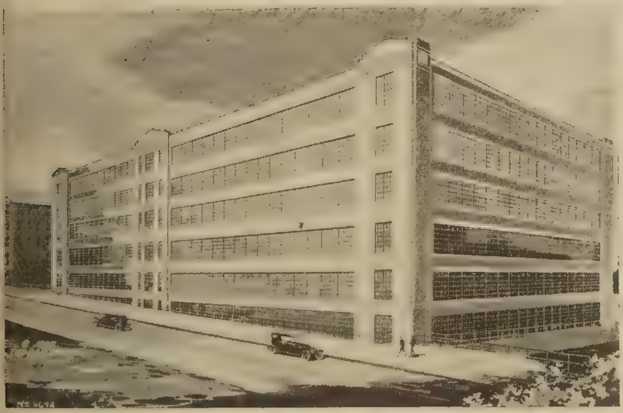
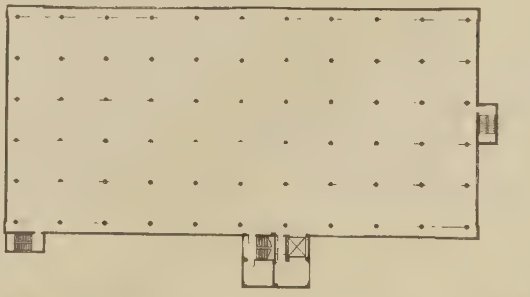


FIG. 1—PERSPECTIVE VIEW OF "DAYLIGHT" BUILDING SHOWING UNBROKEN WINDOW AREAS

This new "daylight" building, which is an addition to the present plant of James Lees & Sons Co., Bridgeport, Pa., is five stories and basement in height and 121 ft. wide by 253 ft. long with a total floor area of about 180,000 sq. ft. and will be used for the manufacture of worsted yarns. It is of reinforced concrete flat slab construction, the top wearing surface of the floor being of maple.

The exterior walls are of brick with terra cotta ornament.

The unique feature in the construction consists of the omission of exterior wall columns, permitting, if desired, an unbroken line of light around the entire building except where broken by stairways or other features.



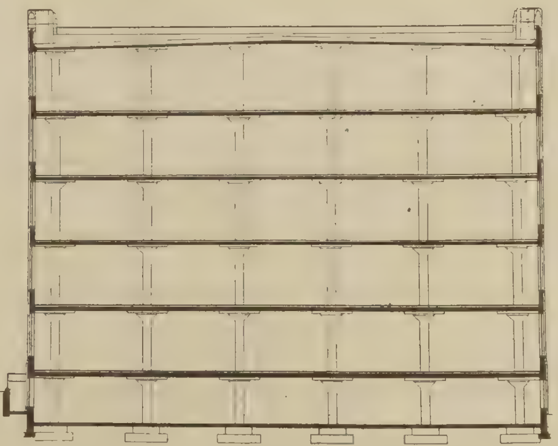


FIG. 2—SECTIONAL VIEW SHOWING CANTILEVER FLOOR SLAB
FIG. 3—PLAN VIEW SHOWING UNOBSTRUCTED WALL SPACE

By reference to the accompanying illustrations it will be noticed that apart from the center and corner pylons which have been added to the facades to give an architectural effect, there is a total absence of pilasters, thus permitting the steel windows to be made continuous. This results in permitting an unusual amount of light to flood the interior of the building, adapting it to the purposes of manufacturing which in this case required a building 120 ft. wide, without requiring an excessive story height to obtain the proper daylight illumination.

This unbroken extent of window space has been made possible by using the principle of the cantilever.

The first row of interior columns is placed 5 ft. back from the wall and the concrete floor slabs beyond the columns to the wall line, the structural walls under the windows being supported by the projecting floor slab.

This method gives not only a maximum of daylight but by the elimination of the wall columns the concrete work is simplified and together with the economy obtained by making use of the cantilever principle, results in a considerable saving in cost in the construction of the building.

Another advantage resulting from the omission of the wall columns with their projections on the inside of the building, is that the installation of work benches and other equipment as well as the radiation for the heating system is greatly facilitated.

The building was designed by the Ballinger Co., Philadelphia, to whom CONCRETE is indebted for the above information.

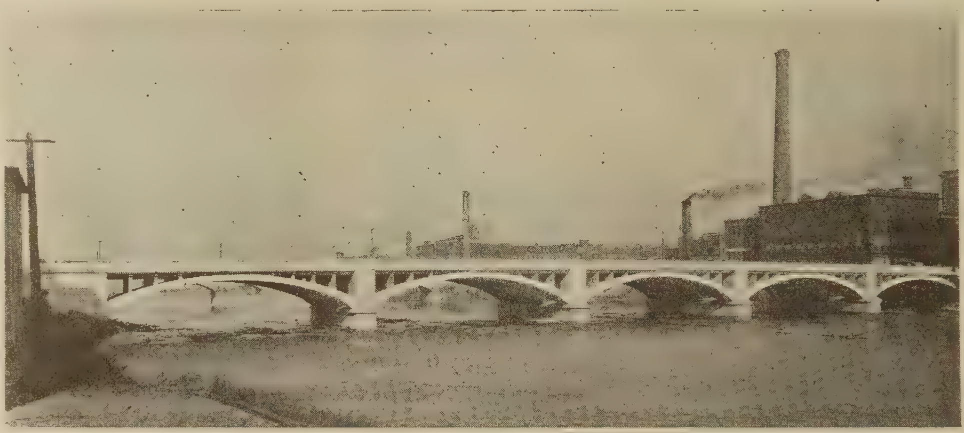


FIG. 1 — COMPLETED STRUCTURE, PEARL STREET BRIDGE, GRAND RAPIDS, MICH.

Traveling Tower Places Bridge Concrete

By A. E. WHILLOCK

RESIDENT ENGINEER

The new five-span reinforced concrete arch bridge over the Grand River at Pearl Street, Grand Rapids, Michigan, erected at a cost of $200,000 and recently opened to traffic, replaces a four-span steel bridge erected in 1886, which consisted of pin-connected Pratt trusses.

GENERAL DESCRIPTION

Due to the low grade of Pearl Street, an open spandrel type bridge was decided upon by the Westcott Engineering Co. of Chicago, Ill., designers of the structure. One feature of the open spandrel type is the space between the arch ribs and the roadway slab, which takes care of a certain amount of flood water. Many of the concrete bridges now being constructed are dirt filled between the arch of the span and the base of the roadway, which would present, in the case of this site, a solid surface to the flood water at high stages of the river.

The Pearl Street Bridge consists of three 90-ft. center spans and two 84-ft. end spans, a 30-ft. west abutment, and a 75-ft. east abutment and approach combined. The four piers are 8-ft. wide, making the total length of the bridge 575 ft. The roadway itself is 46 ft. wide with two 10-ft. sidewalks. There are four arch ribs in each span. The center ribs are 10 ft. wide and spaced 4 ft. apart, while the two outside ribs are 8 ft. wide and spaced 13 ft. from the inside ribs. All of the ribs are 2 ft. thick at the center of span and about 3 ft. 9 in. at the haunch. The rise of the two end span arches is 11 ft. 6¾ in. The two intermediate arches have a rise of 12 ft. 6¾ in., and the center arch a rise of 12 ft. 11 in. The spring line of all piers is the same elevation—9 ft. 9 in. Two comfort stations were constructed in the east abutment under the roadway, with spiral stairways leading from the sidewalks above to the entrance below.

Work on the bridge was started in November, 1921, under the supervision of C. A. Paige, City Engineer, Grand Rapids. The Koss Construction Co., Des Moines, Iowa, were the contractors, with Frank Kratoska, general superintendent, in active charge of work.

EQUIPMENT

A Dravo whirler[2] with a 70-ft. boom was used for all river work. A No. 2 Vulcan steam hammer[3] weighing 6800 lbs., suspended in swinging leads from the boom of the whirler, was used to drive the 16-ft. wooden piles for all piers and abutments. An orange-peel bucket weighing 5800 lbs. and a clam-shell bucket were used for the excavation of the pier foundations and for banking the cofferdams, which were securely waled and sheeted with 4-in. x 8-in. tongue and grooved pine sheet piling. A 6-in. electrically driven centrifugal pump was used to pump out all cofferdams.

CONCRETING

Concrete was mixed at a central mixing plant. An American stiff-leg derrick[1] with a 60-ft. boom was used at the west end of the bridge to load sand and gravel into the elevated bins, and the cement sacks were

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[2] Dravo Contracting Co., Pittsburgh, Pa.

[3] Vulcan Iron Works, Mason City, Iowa.

[1] American Hoist and Derrick Co., St. Paul, Minn.

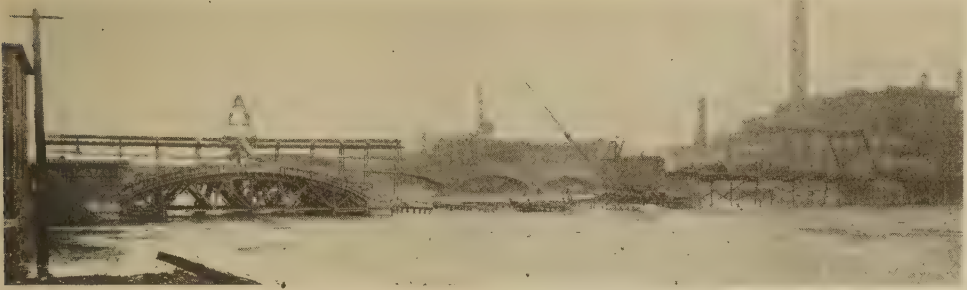


Fig. 2—Construction in Progress. Span on Left Being Poured with Aid of Traveling "A" Frame for Handling Chutes

hauled on a dummy elevator to the platform above, where the cement was dumped into a measuring hopper with the sand and gravel, and from there into the mixer. The concrete was then dumped into a hopper and thence as needed into two hopper cars drawn by a gasoline engine over a wooden trestle above the bridge, whence t was chuted by gravity. The concrete train operated over 24-in. elevated tracks.

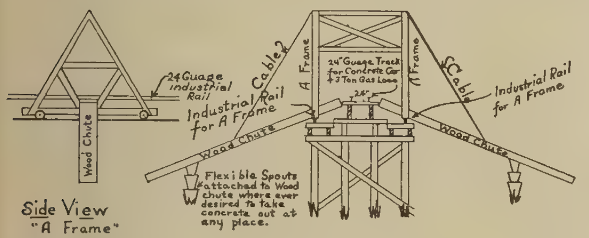

24 Guage industrial Rail
Industrial Rail for A Frame
Cable
A Frame
24" Guage Track for Concrete Car & 3 Ton Gas Loco
24"
A Frame
Cable
Industrial Rail for A Frame
Wood Chute
Wood Chute
Wood Chute
Flexible Spouts attached to Wood chute where ever desired to take concrete out at any place.
Side View
"A Frame"

Fig. 3—Sketch of Traveling "A" Frame to Carry Pouring Chutes. Sketch Not Drawn to Scale

Courtesy *The American Bulletin*

MATERIALS

The pouring hopper or chute was supported by two "A" frames braced together and straddling the track on which the concrete cars were hauled out. Each "A" frame was mounted on two small car wheels which ran on a single rail, one on each side of the track over which the concrete train ran, as shown in the accompanying sketch. As the moves were short, the pouring chute "A" frame was moved with bars and pulled by the gasoline locomotive.

Cement and aggregates were delivered at the job, the sand and crushed rock being stored in piles within reach of the stiff-leg derrick.

About 250 tons of steel reinforcement, structural grade, were furnished by the Corrugated Bar Co., of Chicago; Newaygo cement from Newago, Mich., was used. This cement, combined with the gravel and sand used, made an exceptionally strong concrete of a dull gray color. The outside faces of the arch ribs were bush-hammered to conform in appearance to the Indiana Bedford limestone used on the pier faces and the railing.

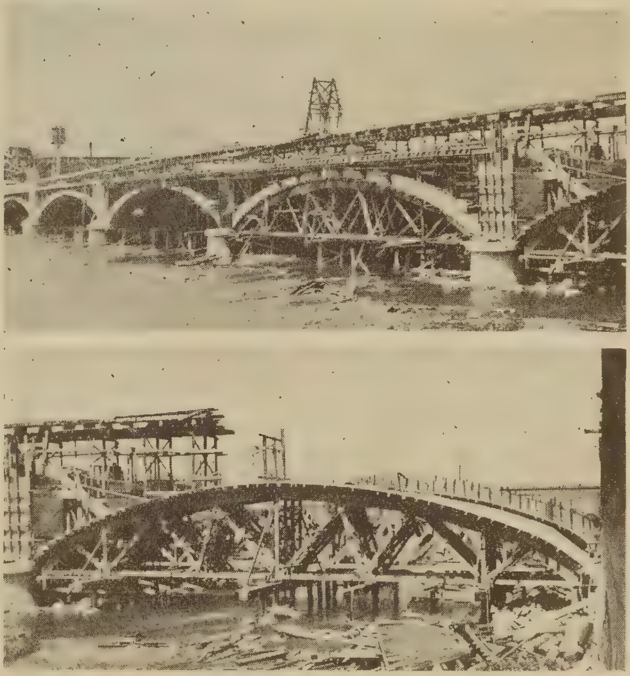
About 7100 cu. yds. of concrete were poured, 1:3:6 mix being used below the spring line and 1:2:4 mix above the spring line.

ARCH CENTERS

On the west bank of the river, 28 arch centers were built and floated to position as needed, three under each of the 8-ft. ribs, and four under the 10-ft. ribs. These arch centers were struck and re-floated to new positions by means of a Dravo whirler in conjunction with a Boss hoist.

PIERS

The four piers, as well as the west abutment, are faced with Indiana Bedford limestone from the spring line to the roadway. The piers are 8 ft. wide at the spring line and battered down to 9 ft. wide at zero elevation, which is about 1 ft. below the bed of the river. The upper step of the pier foundation is 12 ft. wide, 2 ft. 6 in. deep and the lower step is 15 ft. wide and 3 ft. deep, the bottom of the piers being about 6 ft. 6 in. below the bed of the river. Each pier rests upon 140 wooden piles, 16 ft. long, which were driven to refusal. The bottom of the east and west abutments is 6 in. above the bottom of the piers, each abutment



Figs. 4 and 5—Views Showing Construction Methods and Form Work

Fig. 6—Close Up View of Completed Structure Showing Pleasing Finish on Arch Ribs

resting on 220 wooden piles, 16 ft. long. Hard pan was encountered in the south half of the west abutment and dynamite was used. The west half of the river was composed of boulders, coarse gravel and sand, and as the work progressed east, gypsum plaster rock was encountered and dynamiting was resorted to in the excavation of the east pier.

Spiral Stairways

The inside and outside base rails of each stairway are reinforced concrete beams, carried by a large floor beam cantilevered out for the purpose. The upper part of the railing is composed of Indiana Bedford limestone.

Progress

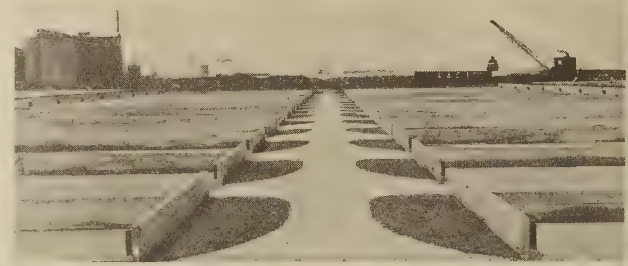
Due to severe weather conditions and high water, very little work was accomplished during the winter and spring months, but after the water receded, about May 15, one pier and one span a month were constructed, a very good record, considering the shortage of materials due to the coal and railroad strikes at the time.

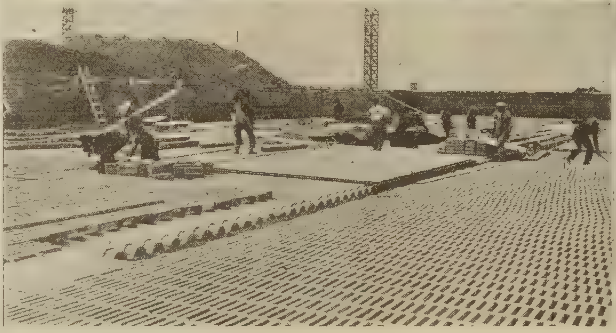
The bridge, as accepted, was finished two months in advance of the time specified in the contract.

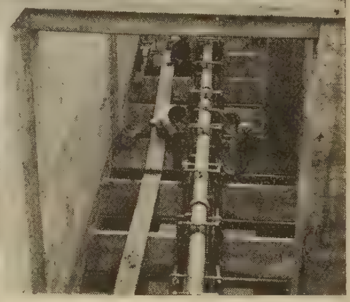
Fig. 1—Calumet Sewage Treatment Plant. View of Sludge Drying Beds

Fig. 2—Trickling Filter Showing Bottom Under Drain System Constructed of Concrete Brick on Reinforced Concrete Foundation

Fig. 3—View of Aeration Tanks Showing Filter Plates and Air Piping. Air is Supplied by an 8-in. Galvanized Cast-Iron Main







Filter Construction in Chicago's Drainage System

Among the many large projects that come under the jurisdiction of the Sanitary District of Chicago is the $4,500,000 sewage treatment works recently completed and now in successful operation. This forms part of the Calumet intercepting sewer system.

The sewage that this plant will care for is dry-weather flow from the area south of Eighty-seventh street and from Blue Island to the State line. This dry-weather flow only, having a maximum of 200 cu. ft. per second, is now brought to the Calumet pumping station by means of the intercepting sewer. There it is raised by pumps and sent to the new treatment works through a 5½-ft. and a 7½-ft. horseshoe concrete conduit built in tunnel. After it has been treated, it returns to the pumping station by another concrete conduit built integral with the first two mentioned, thence to the Sag Canal by a 16-ft. x 16-ft. horseshoe concrete tunnel.

The plant consists of two duplicate units; each consists of two batteries of 16 tanks and covers an area 227 ft. x 297 ft. Between the units are drying beds to dry the sludge, which is brought from the sludge hoppers by means of industrial cars.

The structure has in all thirty Imhoff tanks. Each is 103½ ft. long x 34½ ft. wide, with a total depth of 26.4 ft. Each tank is designed to have a settling capacity of 29,000 cu. ft. These tanks are so designed as to permit ready conversion into aeration tanks.

The sludge beds are 66 ft. long, and vary from 17 ft. 7 in. to 20 ft. 3 in. in width. They are underdrained by a 12-in. tile main drain and two 4-in. tile lateral drains. The filtering material varies in depth from 12 to 19 in. It is made up of a bottom layer of broken stone or gravel, 4 to 10 in. thick. Then comes a 3-in. layer of fine sand, topped by a layer of coarse river or lake sand. To remove the sludge, industrial cars operating over a 24-in. gauge railway are used, dumping at present on the vacant area.

The structure contains 30,000 cu. yds. of concrete. As this may be regarded as substructure, there was an excellent opportunity for the builders, the T. J. Forschner Contracting Co., Chicago, to use chuting equipment. To take advantage of this arrangement the contractors devised a combination of line chutes and counterweights. The chuting plant for each unit consisted of a wooden tower 160 ft. high, from which two lines of chutes were supplied.

Sand and gravel were received in standard-gauge cars and were then handled by a locomotive crane operating a clam shell into a 3-compartment bin of 200-yd. capacity. The material was carried by gravity into a 1-yd. motor-driven mixer. After revolving one minute the aggregate was dumped into a steel auxiliary hopper and thence into the elevator bucket. The auxiliary hopper proved a remarkable saving in preventing delays in charging the hoist bucket.

A crawler crane was used in setting the forms and placing the reinforcing, of which 1,500 tons were used. This crane operated on temporary runways of I-beams.

Fig. 2 shows the floor system of a filter which was constructed as follows:

The subgrade was brought to a level plane by placing sand fills and rolling, and was then covered by a smooth reinforced concrete floor, with a slight pitch from the edges of the bed to the center collecting channel.

The cross ridges were then poured, using chamfered 3-in. x 8-in. timbers to form the grooves or drainage valleys leading to the center collection channel. The ridges thus formed were 4 in. wide at the top, 8 in. wide at the bottom and 3 in. deep. Precast reinforced concrete bricks were then placed on these ridges to form the grillage which in turn supports the crushed stone of the filter. The concrete brick are 1½ in. x 4 in. x 14 in., reinforced with a loop of $\frac{3}{16}$-in. diameter steel wire, and were precast on the concrete floor of the filter before the ridges were poured.

The forms consisted of 1-in. x 4-in. strips about 10 ft. long with 2-in. cleats, projecting 1½ in., nailed on one side of them at intervals of 14 in. to form the ends of the brick. These strips were laid on edge side by side inside of the frame of 4-in. x 4-in. timbers and wedged into place for pouring. The brick were thus formed on edge by filling the form with rather wet mortar and screeding over the edges of the strips. Each frame accommodated about 400 brick.

The forms were stripped by removing the wedges and lifting out the strips, one at a time. The green brick were allowed to remain on the floor where poured and the forms set up in a new position.

No difficulty was experienced in moving and piling the brick when 36 hours old, and it was found that during warm weather the forms could be filled twice a day. Enough forms were provided for about 6,000 brick. An average daily output of about 5,000 brick was realized.

Ralph H. Burke was chief engineer for the T. J. Forschner Contracting Co., and A. W. Dilling chief engineer of the Sanitary District of Chicago.

Strength of Cal Mortar in Laying of Brick Work

Tests were recently made by Prof. John R. Lapham, George Washington University, for the Cal Chemical Co. on the assumption that Cal would be of special service in preventing the drying-out effect incidental to the absorption of brick, which in plain portland cement mortar would tend to make the bond weak. The following abstract of the report of the tests gives a summary of the results obtained:

The series of tests were made to obtain a measure of the bond strength of plain portland cement mortar when used for brick work and to compare it with that of a mortar containing an addition of 5% Cal.

Nature of Tests

To obtain the bond strength of the different mortars when used for brick work, small piers of three brick and two mortar joints were made. The middle brick, in the direction of its length, was laid so that its ends were one-half inch out of line with those of the outside bricks. Fig. 1 shows the type of specimen standing on end as placed in the testing machine. All specimens were capped on the lower ends so that the mortar joints were truly vertical and an even shearing obtained for the two outside bricks. The load was applied at the upper end of the middle brick through a spherical block and this load divided by the area of the two mortar joint faces was considered the bond strength of the mortars. Besides the principal test for bond strength, auxiliary tests for tension and compression were made on the mortars and the usual prescribed tests were run on the brick to classify them according to the standards of the American Society for Testing Materials.

Materials

The cement used in the mortar was the Security brand and was obtained from a shipment which had passed the 28-day requirements of the American Society for Testing Materials for portland cement. The Cal was taken from a fresh lot obtained from the local dealers. The sand used was dredged from the Potomac River and is known locally as building sand. It is washed by the dealer and screened so that it all passes the No. 10 sieve. Two types of brick largely used in local building operations were selected for use in the bond specimens. These were obtained from a building project in the course of construction and no attempt was made to select them, other than that all bricks should be whole and reasonably true to shape and free from warping.

Preparation of the Test Specimens

All the mortars were in the proportions of one part of cement to three parts of sand by weight. Sufficient material to lay up ten bond

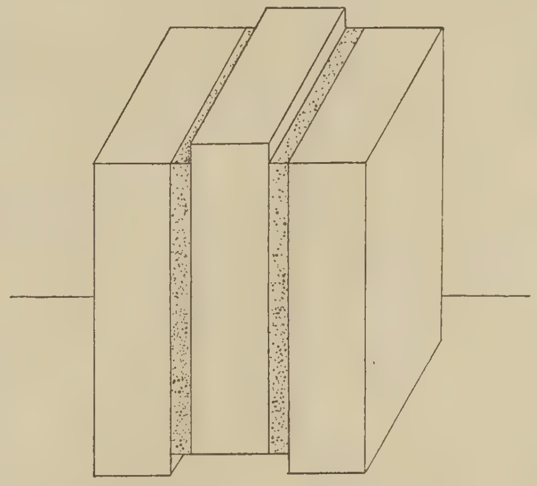


Fig. 1—Sketch Showing Bond Specimen for Testing Strength of Mortar

Table III—Tensile Strength of Mortars

Specimen No.	Plain	5 Per cent Cal
1	193	268
2	189	285
3	160	302
Average	181	285
Increase in strength in lb./in.²		104
Increase in strength in per cent		52.5

Table IV—Compressive Strength of Mortars

Specimen No.	Plain	5 Per cent Cal
1	1145	2248
2	1160	2220
3	1198	2318
Average	1168	2295
Increase in strength in lb./in.²		1127
Increase in strength in per cent		96.5

Table V—Bond Strength of Mortars with Hytex Brick

Specimen No.	Plain	5 Per cent Cal
F1	122	150
F2	94	178
F3	106	182
F4	192	164
F5	146	222
Average	132	179
Increase in strength in lb./in.²		47
Increase in strength in per cent		35.6

TABLE VI—BOND STRENGTH OF MORTARS WITH RED BRICK

Specimen No.	Plain	5Per cent Cal
R1	54	...*
R2	96	140
R3	40	136
R4	52	88
R5	96	222
Average	68	117
Increase in strength in lb./in. ^{2}		49
Increase in strength in per cent		72

*Specimen dropped while handling and not tested.

specimens and mold three standard briquettes and three two-inch cubes was mixed at one time. The mixing was done by hand, using a blunt pointed mason's trowel. The Cal was added to the dry mix in the proportion of 5% to the weight of the cement. The plain mix was gauged with enough water to give a consistency required by the mason for laying up the bond specimens. This was tested for flow on a 30-in. flow table using fifteen drops of the top through a height of ⅛ in. The per cent water to the dry materials was 16.0 and the flow obtained was 179. An effort was made to gauge the mortar containing the admixture to a flow within ten points of that of the plain mix. The per cent water to the dry materials exclusive of the admixture was 17.1 and the resulting flow was 185.

The specimen was finished by cutting away the excess mortar and trimming and filling the joints with the point of the trowel. A square was used to keep the sides of the specimen in line and the end of the middle brick projecting ½ in. beyond the ends of the outer ones. Before laying, all brick were dipped in water but no excess water was standing on the faces when the mortar was applied.

All the joints were ½ in. thick as judged by eye and trueing up the specimen with the square. After completing the bond specimen, the remainder of the mortar batch was used to fill a three gang briquette mold and a three gang cube mold according to usual laboratory practice.

The bond specimens were allowed to lie on the table and tension and compression specimens in the molds for twenty-four hours, when they were removed and stored in a dry room for the remainder of the 28-day period. The temperature of the room throughout the storage period was approximately 70 degrees F.

RESULTS

During the curing period for the mortar specimens, the standard tests were carried out on both kinds of brick.

The briquettes were tested in a Fairbanks shot machine and the results are given in Table III.

A 20,000-lb. Olsen machine was used to test the 2-in. mortar cubes and the results are tabulated in Table IV.

The bond specimens were tested in a 50,000-lb. Riehle compression machine and the results obtained with the two kinds of brick are given in Tables V and VI.

The stresses in all the tables are given in pounds per square inch.

CONCLUSIONS

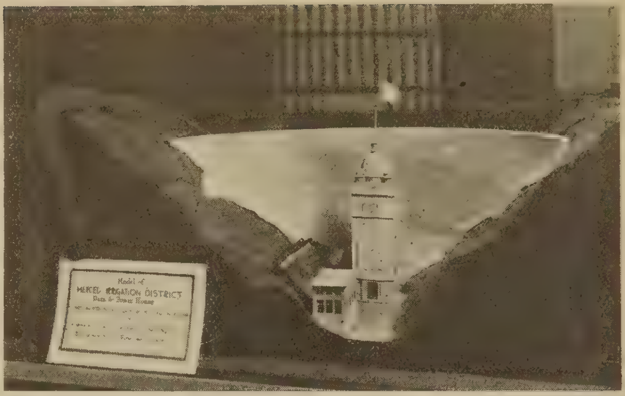
From the results of these tests it is indicated that the mortar containing an admixture of 5% Cal to weight of the cement is stronger in tension, compression, bond with red brick and bond with face brick, than plain portland cement mortar gauged to the same relative consistency or flow.

Under proper control of materials and workmanship it might reasonably be expected that results of similar order would be obtained in actual construction operations.

Models Aid in Location of Power Plants

Exact working models, made from plaster of paris, are proving of the greatest practical value to a firm of engineers in San Francisco, Thebo, Starr & Anderton. These models are built accurately to scale. In the instance illustrated herewith the scale is 20 ft. to the inch.

In general, referring to the use of the model, after the canyon walls are built up it is possible by standing over the model and looking down upon it to determine three or four possible locations for the dam. Plaster of paris models are made at two or three locations in the model canyon. These models are then submerged in a tank and their displacement of water gives the volume contained in the dam section. A comparison of the displacements will show the most economical location.



In this instance, the use of plaster models has resulted in a saving of approximately 30,000 yards of concrete.

The accompanying illustration shows an exact model of the Merced Irrigation District dam, with penstocks and power house. A model of the old Call Building in San Francisco is also shown to give an idea of the size of the project. The dam is 310 ft. high above the river surface. It will be 830 ft. long on the crest and 136 ft. thick at the bottom. It is thus very evident that a slight change in the location may make a great difference in the cost of a structure of this magnitude. The design is an arch with a constant angle. Twin penstocks, 7½ ft. in diameter and a quarter of a mile long, will lead to the power house where 44,000 H. P. will be generated.

Fire vs. Silica Aggregate

The fact that there seems to be no doubt that aggregates containing high percentages of silica cannot be considered as first-class fire-resisting materials, is pointed out in an article in *Concrete & Constructural Engineering* by J. Singleton-Green, under the heading "Action of Silica Under Heat Treatment," from which the following is abstracted:

> The abrupt change of volume of quartz at 575° C. tends to cause spalling of the concrete, thereby exposing the reinforcement. Spalling can be prevented in some measure by the use of wire ties to hold in the concrete, but even if this is successful, there is another danger at higher temperatures. At 950° C. gas is evolved, and from 1250° C. upwards, the volume increases rapidly owing to the formation of cristobalite. These temperatures are easily reached in fires, so that here again quartz is a failure. Even at low temperatures the unequal expansion of quartz in different directions makes the material unreliable.
>
> Flint seems even worse than quartz in this respect. Experimental evidence and practical results concur in proving beyond doubt that flint as an aggregate or a constituent of an aggregate, is capable of even less fire resistance than quartz. Unfortunately, most British gravels contain flint, quartz, or quartz bearing rock as their chief ingredients, and owing to their wide distribution have been widely adopted as aggregates. It is of serious economic importance to ascertain whether it would not be possible to continue the use of flint or quartz bearing gravels for concrete by protecting the latter with fire-resistant coverings.
>
> This detailed consideration of the action of quartz under heat will enable the action of various aggregates exposed to fire to be understood the more clearly, and will help in the classification of aggregates from the point of view of fire resistance.

Not fifty miles from New York City a concrete pavement reinforced with steel mesh was under construction in front of the home of an observant old lady. She watched the proceedings with great interest and later divulged the result of her observations to one of the village trustees as follows:

"Now I know why concrete pavements are so easy to ride on. I watched them lay the bed-springs in the concrete!"

That ought to settle it!

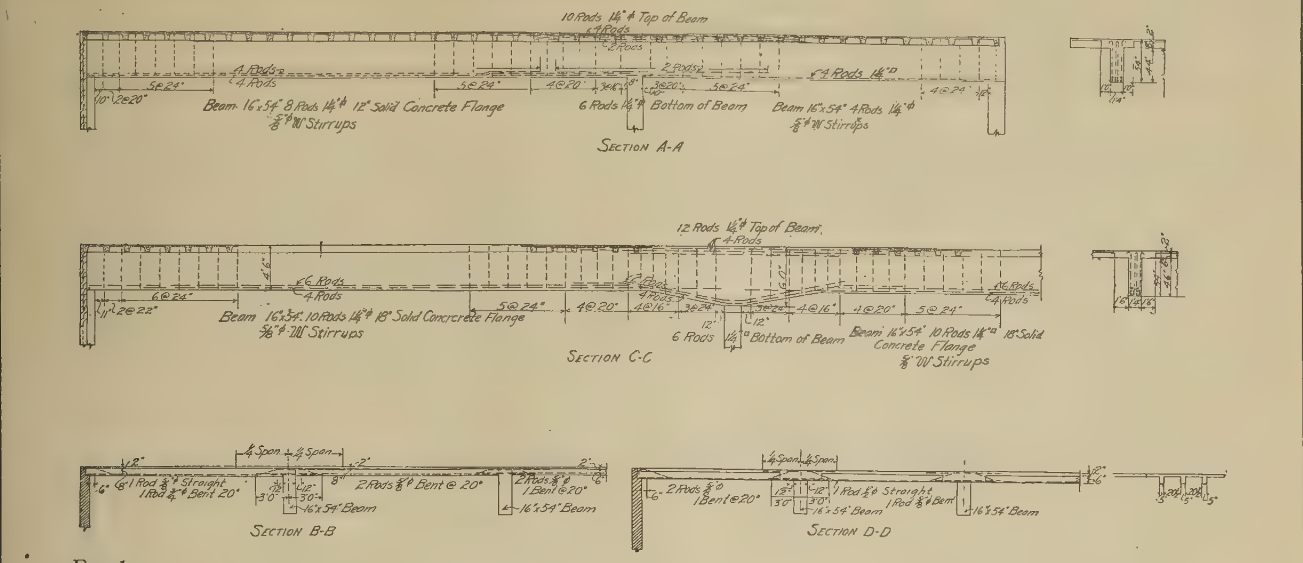
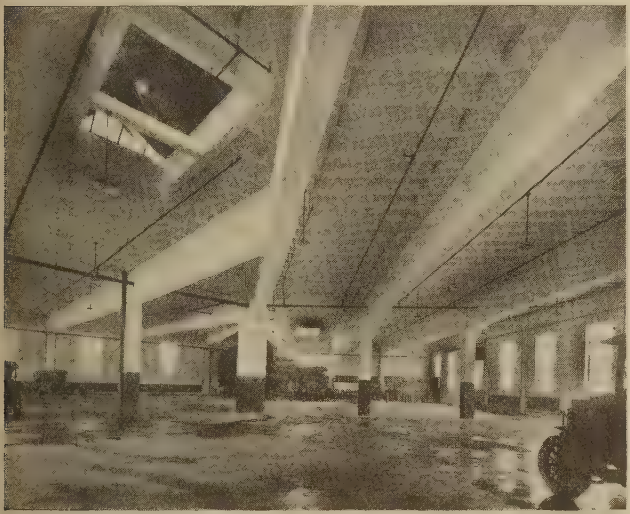


FIG. 1

Universal Concrete Girders in Garage Roof

The building shown in the accompanying illustrations is a garage and small office building erected by Howard Brothers partially for their own use at 412 Dorchester Ave., So. Boston.

It was intended to use steel trusses and concrete slab roof but as the building is situated in the fire limits of Boston, the Building Department required the use of first class construction in the garage, which calls for two inches of concrete over all exposed steel.



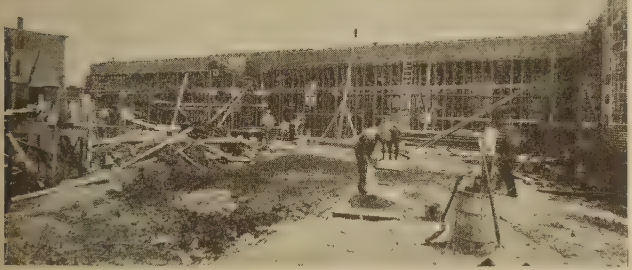


FIG. 2—INTERIOR VIEW OF GARAGE SHOWING ROOF CONSTRUCTION OF UNUSUAL TYPE WITH LONG SPAN GIRDERS

FIG. 3—CONSTRUCTION VIEW SHOWING CENTERING USED TO CARRY LOAD OF CONCRETE IN GIRDERS

In order to handle trucks in the garage, columns were prohibitive, so the construction shown was adopted, which proved cheaper than fireproofing the steel trusses.

The columns supporting the girders, the longest clear span being 67 ft., go down through peat and bog to approximately 28 ft. below the floor grade.

The roof plans are shown in Fig. 1. Fig. 3 shows the centering used to carry the load of the concrete; the girders are 16 in. x 54 in., as the nature of the soil required heavy bed pieces. The forms were crowned well and the girders stripped with a very slight crown.

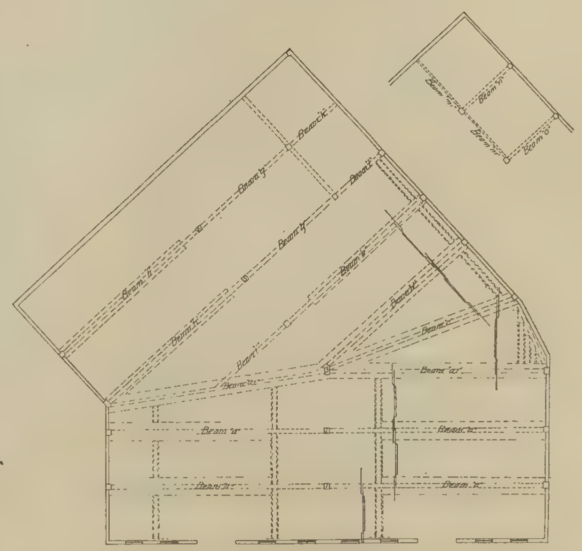


FIG. 4

All concrete in columns, beams, stairs and roof slabs was of 1:2:4 stone mix. Footings were of 1:2½:5 stone concrete.

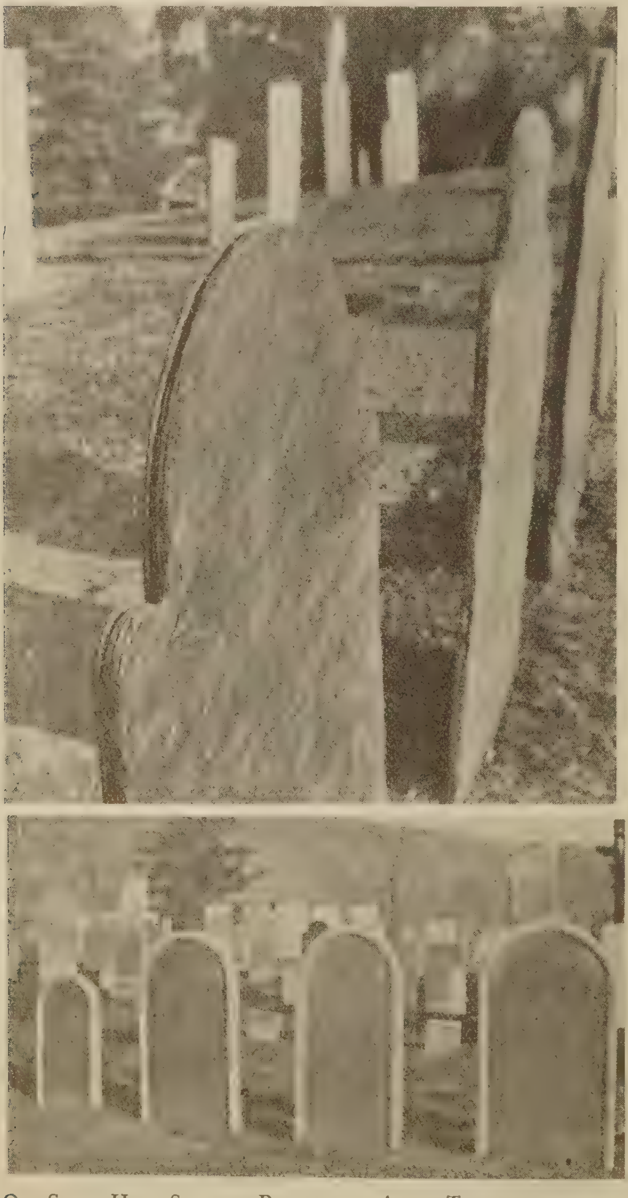
A pint of excess water in the mix is as bad as a pound less cement.

Preserving Old Head-Stones With Concrete

A method of preservation of old headstones of slate and stone, marking the resting places of the early pioneers, has been used successfully by William J. Pentland, Brattleboro, Vt. The pictures show what he did with several old slate markers with a frame and back slab of concrete.

Mr. Pentland had previously repaired several old headstones in Prospect Hill cemetery by capping them with copper. Recently a Chicago man came to Brattleboro to look up the graves of his ancestors who have been buried for over 100 years in Prospect Hill cemetery. He found the old slate markers in very bad condition and was told by the caretaker of the cemetery that the same treatment could be accorded those stones as had been given those which were capped with copper by Mr. Pentland.

Not satisfied with the results by the use of copper, Mr. Pentland conceived the idea of incasing the markers in a thin layer of cement, thus protecting the sides and back of the stone, leaving only the chiseled wording on the face of the stone exposed. In addition, he figured that such a treatment would add to the appearance and life of the stones, and at an extremely small cost.



Old Slate Head Stones—Before and After Treatment

The old headstones were first removed from the cemetery and taken to Everett Phillips' carpenter shop, where they were carefully cleaned, special attention being given to the cracks in the stones where the constant exposure to the weather had split them.

A wooden form was then made somewhat larger than the dimensions of the stone to be treated. The inside width of the form was two and one-half inches greater than the width of the stone. The inside of the form was then lined with metal, preferably zinc, so that the stone, when finished, would be smooth. At the end of the form where the top of the stone was to be placed, the zinc was made to conform to the shape of the stone which in some cases is semi-circular and in others leaf-shaped.

The stone itself was laced with quarter-inch galvanized mesh on the sides and back, thus forming a reinforcement for the rolled edges and the back of the stone. A rich mix was put into the form to the depth of two inches. Upon this mixture, the marker was placed face up. The marker was then "puddled" into the cement until it squeezed up between the sides and top of the stone and the inside of the form. More cement was added wherever needed so as to provide enough cement for a one and one-half inch bead around the stone edge of the face except at the bottom. As the cement hardened, the bead was more perfectly shaped by a piece of wood at one end of which was cut a circular design. By passing this design around on the bead of cement as it dried, a perfect outline was obtained.

Each stone was similarly treated, being incased in cement sufficiently deep so that when placed back in the ground, the cement portion extended six inches below ground.

Engineering Standards

The 1923 Year Book of the American Engineering Standards Committee, which has just come off the press, shows that great progress was made during the last year in standardization projects affecting civil engineering and building trades. Thirty-five standards have thus far been approved by the committee and the following seven are of special interest to the building trades and civil engineering professions:

Specifications and Tests for Portland Cement

Specifications for Fire Tests of Materials and Construction

Standard Test for Toughness of Rock

Specifications for Drain Tile

Code of Lighting Factories, Mills and Other Work Places

Standard Method for Distillation of Bituminous Materials Suitable for Road Treatment

Method of Test for Penetration of Bituminous Materials

According to the report, 121 industrial standardization projects were definitely under way or had been completed and the standards approved at the end of the year. Twenty of these projects have to do with civil engineering and the building trade.

The American Engineer Standards Committee essays to serve as a national clearing house for engineering and industrial standardization, to act as the official channel of cooperation in international standardization, and to provide an information service on engineering and industrial standardization matters. The method employed by the committee is simply a systematic plan of cooperation by which all organizations interested in any particular standardization project participate in deciding whether the work shall be undertaken at all, in formulating the standardization, and in its ultimate approval as an "American Standard" or a "Tentative American Standard."

Selling Concrete Block With Newspaper Ads.

By C. O. Gochnauer
Gochnauer's Concrete Block Co., Appleton, Wis.

From an address at Convention of the Wisconsin Concrete Products Association.

About 28 years ago my father, M. K. Gochnauer, with John Driscoll began the manufacture of concrete products in Appleton. Later Mr. Driscoll withdrew from the firm and Mr. Gochnauer continued in the business until his death in 1915. Through the efforts of these men, who insisted at all times on a quality product, concrete blocks have had a good name and have been widely used in Appleton and vicinity.

After Mr. Gochnauer's death in 1915 my brother and myself took over the business. When anyone would approach us on any advertising proposition our answer was "why should we advertise? There is an advertisement of our work in every block in town. The masons and contractors do all of the necessary advertising."

Then a third block making outfit opened a plant in Appleton. The owner personally visited the various contractors as well as every hole in the ground, telling what good block he was making. This was good medicine for us. We changed from passive to active advertising. Before this, if accused of it, we were perfectly willing to admit we made a good block. We decided then, to find out how good a block we did make and to tell the world.

Three blocks, taken from stock, were tested at the University of Wisconsin when 28 days old. I will admit that it was with some misgiving that we opened the report on these tests when it came from Madison. We were not quite sold on our own product, but the tests more than met expectations. We entered into a contract with the Appleton *Post-Crescent* for an ad to appear every Saturday evening. The first ad was a half page report on the tests.

The purpose of our newspaper advertising has been for the most part educational. It has been our aim not only to provide the masons and contractors who use our product with selling talk to reach those who have already decided to use concrete blocks in their building, but also to reach the general public so that if at any future time John Jones should decide to build a warehouse, or Sam Smith a store or Andy Gump a factory, his first thought would be "Why not use Gochnauer's Tested Concrete Blocks?" It is too late after plans are drawn and specifications written.

Most of our advertisements are two columns wide by 2½ in. deep. An ad. of this size costs us $1.80. Each of these ads carries but one idea. We try to put that idea in such a way that it will have a punch to it. We have been very fortunate in securing good locations for these ads and to have them so dressed that they catch the attention.

Last fall we had three blocks tested at Marquette University. The results of these tests were used in a quarter-page ad.

We also supplement our newspaper advertising with post card pictures of various buildings in which our blocks have been used, and by letters calling attention to the quality of our product.

STEAM CURING

ADDS 5% TO 10% TO THE STRENGTH OF A BLOCK BY KEEPING THEM WARM AND DAMP. WHY NOT TAKE ADVANTAGE OF THE MOST ADVANCED METHODS OF BLOCK MAKING BY USING

Gochnauer's Concrete Products
BEST BY ANY TEST

**BUILD THAT VEGETABLE
CELLAR NOW**

Partition your cellar with 6-inch CONCRETE BLOCKS. Keep your fruit and vegetables away from the furnace heat.

Gochnauer's Concrete Products
BEST by TEST

**UP TO A STANDARD
NOT
DOWN TO A PRICE**

**GOCHNAUER'S CONCRETE
PRODUCTS**
Corner Meade and R. R. Tracks

More Than 2,000 Buildings in Appleton Have GOCHNAUER'S CONCRETE BLOCKS in Some part of Their Construction.

**GOCHNAUER'S
Concrete Products**
939 Meade Street

A ton of coal costs $17.25
Here today—gone tomorrow
A ton of CONCRETE BLOCKS costs $7.18
And is yours forever

Gochnauer's Concrete Products
BEST by TEST

Our method of advertising on our delivery trucks might be of interest. A sign reaches from the top rear of the cab to a stake on the rear of the platform. In the center of the sign is a perspective of a concrete block with Gochnauer painted on the side. To the front and rear are the words "Concrete Products." This puts the sign up out of the way and at the same time makes it very prominent.

Seeing is believing—to some people compression and absorption tests mean nothing. We also advertise by demonstration. Truck drivers are instructed to throw a few blocks from every load into the basement of any job they haul to.

When visiting a store job, where our blocks were being laid last fall, one of the masons called my attention to a broken block, wanted to know what kind of blocks Gochnauer was furnishing anyway. I picked up a block he was about to lay, hurled it over the side of the building. "What's the matter? Wasn't the block any good?" was his query. "Oh, I'll bet you were trying to see if it would break. Shucks, that wouldn't break it." The fall was 50 feet. The four masons and a dozen

GOCHNAUER'S BUILDING STONE STANDS THE TEST

MACHINE TAMPED—STEAM CURED

Are they Strong?

Report on test specimens A & B made on Sept. 24, 1921 by Prof. M. O. Withey at Engineering Building, University of Wisconsin.

Specimen A

Crushing load of 289,000 lbs. (145½ tons.) Area of cross section 191.1 sq. in. Unit compressive strength 1512 lbs. per sq. in.

Specimen B

Crushing load 449,400 lbs. (224¾ tons). Area of cross section 190.6 sq. in. Unit compressive strength 2357 lbs. per sq. in.

State Building code requirements 700 lbs. per sq. in. Average of A & B 1934 lbs. per sq. in.

Are They Damp?

Absorption Test Specimen C. made by Prof. M. O. Withey, Sept. 24, 1921, etc.:

Weight when baked bone dry, 93.4 lbs.

Weight after immersion in water 48 hrs., 96.6 lbs.

Gain in weight 3.2 lbs. or 3.43%.

State Building Code requirement under 10%.

Compare this with the absorption of Common Brick at 15%, Face Brick 10%, Sand Lime Brick 12%, Sandstone 3.7%, Limestone best .07 to 6.17%.

Are They Durable?

Tested by you in 26 years of actual use in Appleton.

In more than 1175 foundations.

In 35 residences of first story or more.

In 15 factory buildings.

In 16 schools.

In 23 garages and barns.

STATE OF WISCONSIN,
Outagamie County—ss.

C. O. Gochnauer being first duly sworn, on oath says that the Test Specimens A, B and C, tests on which are recorded above, were stock blocks 28 days old at time of test, were not made with the intention of having any test made on them and conform in every way as to the proportions of materials and method of cure to the stock blocks manufactured.

Subscribed and sworn to before me this 28th day of September, A. D., 1921.
(SEAL) Mark S. Catlin, Notary Public. C. O. GOCHNAUER.

LARGE SPACE NEWSPAPER ADVERTISEMENT OF GOCHNAUER BLOCK

tenders have been spreading the results of that test and we also used it in an ad.

As to results from our advertising—I am rather fond of hunting. At one time last fall my dog was gone for three or four days, when we ran this ad in the paper.

Lost—Strayed—or Borrowed
Our Hound Dog "Pat"
The dog you have all seen riding
on our delivery truck
GOCHNAUER'S
CONCRETE PRODUCTS
TELEPHONE 615

The dog came back next morning. Whether he had read the ad or not we do not know, but we do know that people are reading them. The contractors and mason helpers are reading them and spreading the good word. The property owner is insisting more and more that Gochnauer's tested blocks be used in his construction. But better still, in Appleton last year there were more large buildings built of concrete blocks than in any five previous years.

If you have done some successful concrete products advertising, tell the other fellow about it and the results—write the Editors of CONCRETE.

* * *

The Semi-Annual Index to CONCRETE, Vol. 22, January to June, 1923, will soon be ready, and it will be mailed to all subscribers who ask or have asked for it.

* * *

Modern Methods Constructing Concrete Pavements

By E. G. Willemin
District Engineer, Michigan State Highway Departmfnt

Presented at Michigan Conference on Highway Engineering, February, 1923.
University of Michigan, Ann Arbor, Michigan.

In recent years, perhaps in no other type of hard surface pavement has the development of methods been so marked as in that of cement concrete. The popularity of hard surface pavements is the cause of keen competition in type, as well as a very keen competition among builders of each type to cut production costs. Manufacturers of highway construction equipment join in the competition to furnish necessary machinery to the builder to cut the costs. The scarcity of labor and the uncertainty of material delivery have been prime factors in inducing the highway construction industry to employ more highly developed machinery. The tendency is to more closely standardize the product and in turn increase its rate of production. In promoting this tendency we approach the industrial plant idea to place the product on a quantity production basis. A new perspective has been gained in the consideration of a road project as a coordinated entirety, rather than a conglomeration of its parts. The bidder now views a prospective job by analyzing its parts and then assembling the parts into a whole. The vital parts receive first consideration; his organization may be the heart of his job, it makes the job go, but his transportation facilities and his material supply are equally as vital to his well-being as a builder as his arteries and life blood are to his personal well-being. His consideration of supply and transport of material is interlocked with local aspects of the job such as soil, gradients, width of sub-grade, water supply, condition of adjacent roads, length of the project, supply of common and skilled labor, length of live and dead haul, availability of local materials, time limit of the contract and his capital investment.

The experience gained so far in the design and fabrication of road equipment has led to types that are labor saving devices, dependable at all times. Present construction demands sturdy heavy duty types. Standing beside a modern mixer while in operation, one can well experience the same thrill, a feeling of awe, of surplus power and strength that one gets from the modern locomotive. The certainty of mechanical performance is eliminating a source of risk to the builder. Costly delays due to mechanical imperfection will soon become the exception rather than the rule. Time, study, analysis, can well be applied with profit to each of the more costly major mechanical operations. Minor operations can then be coordinated with the major operations to give a well balanced plant and organization. In glancing over a season's record, a sensational run on a single day is striking, but to the experienced builder the average runs per day spread over the season's work tell whether financial returns will be written in black or red ink. There are certain features with which road building must always contend, such as variable working location and lack of protection from the weather. The tendency now is to eliminate the factor of seasonal work as much as possible by starting work earlier. In any event, the factor that counts is continuous production.

I have spoken of the physical and mechanical aspects as they may affect present methods. The economical and social aspects also show signs of recent development. Large contracting firms, with unlimited capital, are being attracted to this field of construction. Due to the larger plant investments and necessity of closer supervision, there is a decided improvement in the personnel of the organizations. From the social standpoint the use of more highly developed machinery tends toward a general improvement of the class of labor formerly employed.

In the consideration of the present methods of construction of cement concrete pavements, it will be assumed that the foundation, subgrade or earthgrade and the drainage features of the road have received the painstaking care that is now considered absolutely necessary in good practice. For convenience the subject will be handled in the sequence of operation, that is, the methods employed in (1) the preparation of the flat subgrade or earthgrade for the slab, (2) the movement and manipulation of material, (3) the finishing of the concrete surface. The subject of construction details will also be considered as to their effect upon the builders' and users' viewpoint.

SUBGRADE

In the preparation of the flat subgrade for the slab, it is the practice in Michigan to channel out sufficient earth from the full width of the slab to such depth as to give the proper cross section and volume of earth to complete the shoulders at the edge of the slab. On fresh subgrade or upon loose soils a grader serves well to remove the excess earth outside the shoulder line for future use. On subgrades well packed by traffic or in stiff soils, it becomes necessary to use heavier equipment in such tools as the plow, scarifier and grader. There has been and still is considerable discussion as to the merits of channeling for the slab. From the engineering standpoint in controlling volumes of earthwork, it is necessary to use the surface of the flat subgrade or earthgrade as the plane which eliminates the item of excavation from further consideration. On the other hand, it means that the earth channeled from fills is handled twice. This fault is partly remedied by building our earthgrades 6 in. wider on each side than the finished width with the idea of using the wedge of earth of the inner ditch slope as a source of filling material for shoulders. In flat sandy country, channeling may be almost dispensed with while in rolling country it becomes more difficult for the engineer to balance the deficiency that may exist in cuts and fills to avoid endwise haul. In practice it has been found advantageous to have the engineer actually channel out a strip several feet wide to the cross section as shown on the plans, to demonstrate that in that class of soil sufficient depth has been reached, with or without the wedge of earth on the shoulder, to fill out adequately the shoulders on the edge of the slab to its proper slope and section. The present tendency is to eliminate side ditches as much as possible, but still provide adequate drainage and yet leave no ghastly borrow pits on the back slopes. These restrictions imposed upon the engineer make close control of earth work necessary at all times.

TRANSPORTATION OF MATERIAL

The vital importance of the supply and transportation of material has already been touched upon. The supply should always be at least equal to, but never less than, consumption requirements to insure continuous production with a well balanced plant. The facilities for unloading materials from a source involving railroad haul and for its proper storage are therefore given careful consideration. A layout that gives a minimum handling usually guarantees a decreased cost. Each time material is picked up to move, costs rise also, due not only to the cost of movement but to waste of material as well. Yard layouts are now designed to elevate raw material but once, if possible, and to take advantage of gravity movements thereafter. The clam shell, or adaptations of it, equipped with a ¾-to 1-yd. bucket is in general use and proves economical. A mobile machine of the caterpillar type gives general satisfaction, as it reduces switching charges and needs no supporting track to run on. From this point on, the methods of handling materials will be determined by the location of the mixer in respect to the road, so storage and loading methods will be discussed under the different plant types. Transferring our attention now from the unloading plant to the mixer, we find that in general two classifications may be made as to the location of the mixer: (1) the mixing operating on earthgrade fed by transportation units, (2) the mixer operating off the grade and delivering a wet batch to the transportation units. Under the first classification we may subdivide into three types: the wheelbarrow or stocking of subgrade system, the central proportioning plant, or a type—not used to any considerable extent—which consists of a mixer over which storage bins are erected, the bins being filled by a hoisting arrangement and the whole cumbersome affair mounted on rails. Due to the fact that the transportation element must also be considered with each type of mixer layout, I will continue the enumeration of types of mixer layouts not operating on the subgrade, then return to a closer study of each type of layout in its relation to transportation as well as its peculiar advantages over other types. Under the classification in which the mixer does not operate on the grade we have two types: (1) central mixing plant with mixer fixed and set up adjacent to main source of material supply, (2) a modified central mixing plant where the mixer requires one or more set-ups usually adjacent to the road, its location determined by stock pile or source of supply. It will be noted that the essential difference in types as far as transportation is concerned is the hauling of a dry or a wet batch. There are other considerations previously mentioned, however, that largely determine the location of the mixer in respect to the road and the methods of transportation.

With Mixer on Subgrade

With the mixer operating on the subgrade, let us first consider the wheelbarrow method. This method is still in use, but usually in localities where unskilled labor is plentiful and cheap. Aggregates are usually stocked upon the subgrade. In such a case, it is necessary to space the loads of each type of aggregate with care to save long distance wheeling. This requirement would mean a very trustworthy foreman in charge of unloading. Again, with materials stocked on the subgrade, any corrections that must be made to the subgrade after the aggregates are placed, are very costly. For this reason unusual care must be taken to correct all ruts and unevenness of the subgrade prior to stocking. There is a considerable loss of material, as aggregates cannot be picked up clean and economically without combining parts of the subgrade with it. This waste material may run as high as 10 %. The human element enters into this method too largely, there is congestion, questionable morale and heavy labor turnover. There is no advantage in stocking subgrade in anticipation of scarcity of material that cannot now be offset by dry batch delivery from the stock pile. A late development is the use of belt conveyor as a substitute for the wheelbarrow. This contrivance eliminates the common labor element, but does not reduce waste of material. When aggregates are not stocked on the subgrade, delivery of materials to the mixer may be made by industrial railroad, light or heavy truck. The reliability of mixer supply, however, is questionable in this method. Moreover, it has been demonstrated that the batch system handles the transfer to the mixer more economically. Unless material can be stocked at railroad siding, there is a possibility of the accumulation of demurrage charges.

Central Proportioning

As the name implies, the central proportioning plant proportions the aggregates in a dry batch to correspond to the capacity of the mixer. The plant may be composed of fixed or movable loading bins that serve for storage of aggregate or a tunnel arrangement designed to accommodate an industrial train. Batches may be proportioned by hoppers on the discharge chute of the loading bin or tunnel or by volumetric measurements in compartments of a batch box or of partitional truck bodies. Batch boxes may be of the tilting, side discharge or drop bottom type. If cement is included in the batch, separate compartments for it are preferable. Covers are now provided for cement compartments as a safeguard against wind and rain. The ideal layout for loading is to elevate material but once, so that handling of materials to the transportation units is by gravity. In some large layouts using truck haul, separate loading bins for each aggregate are used. This arrangement requires two stops. In smaller layouts, where truck haul is used, it is possible to have sand and gravel compartments for each loading bin, thus eliminating one extra stop of the truck per trip. There is, likewise, opportunity to design tunnels so as to economize on train loading time and dead storage of material.

Light vs. Heavy Trucks

In the consideration of the effectiveness of the central proportioning plant we are at once confronted with our transportation problem. In general, the light or heavy truck or a combination of both or the industrial train alone or in truck combinations is employed. Tractor train haul has not proved adaptable as an economical method. A fleet of light trucks alone, equipped with pneumatic tires, capable of handling one 4-bag batch, has proved successful under certain hauling conditions.

It is argued that the cost of delivery of material in this manner is no more than with a wheelbarrow layout and that the cost of operation and wear of the light trucks does not exceed the cost of re-shaping the subgrade that is necessary with certain soil conditions when heavy trucks are used. On a long haul by truck delivery, it is also argued that a saving can be effected in handling of material by delivery in heavy trucks to a stock pile, provided the heavy trucks can dump directly into hopper of a loading bin to be later discharged into hoppers for loading light delivery trucks. The cement may or may not be added to the batch at the central proportioning plant. Depending upon the source of cement supply, it may prove feasible to stock the cement in a movable storage house on the road. The methods mentioned contemplate the material brought by truck or train to the mixer, with the mixer gradually progressing forward. A recent plant layout using dry batch, heavy truck delivery was so arranged as to temporarily fix the location of the mixer every 1,500 feet on the subgrade with the mixer discharging concrete into light trucks for placement on the subgrade. It is needless to say that a turntable would be one necessary piece of equipment in such a layout.

Among road builders, the problem of the transportation unit to be used for a given project creates considerable discussion. One builder's experience may have involved the light truck, another the use of heavy truck while still another the industrial railroad. Contracts have been completed by the use of each type or of light and heavy truck combinations equally successful from the standpoint of the contractor. It is my opinion that the temperament of the contractor and his organization enters into the choice; in other words, a personal equation may be involved. Some builders are willing to take more grief from their equipment than others, as manifested by the maintenance they give the equipment. Besides this consideration there are the more important ones of plant investment, fixed and operating charges. It has been found that certain economical principles apply as well to road equipment as to other types of machinery. Let us consider a few of these principles. It cannot be disputed that where interest charge on the investment plus depreciation is exceeded by the loss due to costly delays in the use of old equipment, that new or better equipment should have been purchased. The economy of new or well maintained equipment is apparent where repairs or replacements are difficult to obtain. A piece of equipment is not justified in a well balanced plant unless it coordinates closely in output with other units of the plant in giving continuous production. This does not mean, for instance, that the capacity of the clam at the unloading plant per 10 hours must be equal to the total aggregates handled in 10 hours by the mixer. Its capacity may be less, it may work overtime to maintain the balance of supply with demand, but its capacity should be such that demurrage does not pile up unnecessarily due to erratic shipments, or delays caused to other plant units. Equipment standardized such as mixers now are, should not be overloaded. The machine may stand the strain for a time, but maintenance and depreciation charges will soon discount the apparent advantage. Workmanship suffers also.

After a road builder has bought his plant and completed a successful season's work, he has no assurance that his plant will balance with the requirements of the next job. There is an opportunity at times for the state and counties to adapt projects to plants. It has not always been possible to do this, however, because of considerations such as taking care of traffic during construction. It is sometimes advantageous to advertise a short job. A small job with a small organization and small overhead can compete favorably in unit price with a large job with large organization and high overhead. The risk of delay is more costly in a large plant layout. The small plant layout has proved adaptable to a larger variety of jobs. It is true that the large plant may not yet have had the chance to demonstrate its worth due to the uncertainty of material supply. To date it is my opinion that the average net return on the money invested for the large plant has been lower for a season's run than the small plant. The efficiency of the construction organization is responsible to a great degree for its success or failure. With improper equipment an efficient organization soon loses its efficiency and its interest in the welfare of the work.

With light truck haul, a light truck being considered 2-ton capacity or less, the light truck makes up in speed what it lacks in capacity. Its use is favorable with comparatively short hauls, it is easier on the subgrade, parts are more readily replaced in case of breakdown, the time lapse is shorter after a rain for trucks to start running upon roads and the interest charge on the capital invested is less. An apparent advantage is the fact that truck drivers may be obtained at cheaper rates than for heavy trucks, also mechanics, but how true ultimate costs will be cut is problematical. The investment of the owner in spare parts, however, is appreciably cut. With heavy trucks, on the other hand, a long haul is more advantageous. Due to the fact that for a given volume of haul a lesser number of heavy trucks are needed, they require less field supervision, there are fewer units on the road to pass each other, less time to load than in four or more light trucks, and they are on the subgrade a shorter time in unloading the same volume, thus disturbing subgrader work less. The drivers take more personal pride in the performance of their heavy truck. In fixed charges, the storage charge per heavy truck is less than for its capacity equivalent in light trucks, license fees are accordingly reduced, while risks on insurance, liability, fire and theft are less. The charge off for the life of heavy trucks can be taken as twice that of light trucks. Again, in sub-letting truck hauls, it usually proves more satisfactory to sub-let to heavy truck haulage concerns, as they are more substantial and trustworthy in general. There are evils in sub-letting truck hauls, however, due to the fact that the contractor loses his absolute control over his transportation units and condition of his subgrade. Trucks equipped with adequate tires for the capacity of the truck are essential as a remedy for subgrade troubles.

INDUSTRIAL RAILWAY

The heavy investment necessary for industrial railway equipment is warranted only on longer projects. Their layout and operation require close study in regard to soil conditions, weight of track, grades, booster engines, temporary and permanent passing switches, loading facilities and tracks using gravity wherever possible in favor of the load. Undoubtedly, railroad economics can be profitably applied on some phases of its operation. It has been found that heavier loads should be drawn with the same power unit, or it is more economical to boost on heavy grade than it is to cut the load. Within the last two or three years the power unit has increased in weight and consequently increased the tractive effort with the necessary power. The 7½-ton gas locomotive and the 8-10-ton steam locomotive are preferred. The industrial haul is more reliable in general as a transportation unit, than the truck method. The reliability of the industrial haul should lead to continuity of production. Against this advantage, we must charge added interest and depreciation of plant investment.

In the comparison of the effectiveness and economy of any transportation unit, the cost per ton mile haul seems the logical basis for comparison. On a given project with a given output of the finished product, the volume of material required in tons is constant. The mileage and time involved in hauling are the variable factors of the ton mile basis. We may decrease the tonnage per transportation unit and increase the speed of each unit or vice versa, and obtain the same output within reasonable limits. The analysis of these factors for each project gives the builder the clue that he seeks as to the type to employ.

CENTRAL MIXING

As previously stated in the plant layout where the mixer does not operate on the subgrade, we are concerned with the so-called central mixing plant or a modification of it. In one case the mixer is fixed quite permanently, in the latter case the mixer can be shifted from stock pile to stock pile. The former must have materials brought to it, in the latter the plant is more flexible in that respect. The operation of the central mixing plant is particularly affected by its design. The bins should deliver a uniformly graded type of each aggregate. The proportioning of the batch should be done just prior to discharge into the mixer. The central mixing plant layout centralizes activities, it would therefore cut supervision costs. This is not so true, however, of the modified type. The modified type might be used economically where heavy truck hauls are necessary to various stock piles along the road, with the soil conditions of the subgrade such that only light trucks could be used for hauling wet batch. Many different types of portable elevators are now on the market for handling aggregates from stock pile to truck or industrial railroad, that could be adapted to the modified central mixing plant.

Many specifications do not allow, others restrict, the use of concrete mixed by the central mixing plant method. Those that oppose its use contend that segregation of aggregates occurs in the concrete in its transportation especially where long hauls are involved over rough roads. Truck haul is advisable as by it individual batches are delivered to the project in the least time. Tests were made a year or more ago to determine the probable safe maximum haul of concrete mixed in a central mixing plant. The results as given in *Public Roads*, the former official publication of the United States Office of Public Roads, show in a general way the relative strength and consistency of gravel concrete when hauled in a wet batch and tested at various periods of time up to three hours after initial mixing. The concrete was mixed to a consistency to conform to a 2-in. slump with standard apparatus. Cylinder specimens were made for testing according to standard field practice. It is stated that the experiment indicates that the most practical way to utilize the central mixing plant in concrete road construction is in connection with a machine finisher. It also indicates that so long as the concrete is workable after a period of hauling, the strength will not be affected. Further experimental work was to be conducted on the effectiveness of this method.

One of the more recent developments in the mixing of aggregates for concrete is the so-called "Inundation Method." It consists of measuring the sand aggregate in a container which has previously been partly filled with water in such quantity that when the container is level full the sand is completely soaked. The effect of moisture on sand is variable, depending upon the physical characteristics of the sand. Experiments show that the swell of dry sand measured after moistening by the addition of 2% of water by weight may easily be 15%. With like increments of water added, the volume tends to decrease to the saturation point. With a soaked sand, volume measurements become more constant. By this method the consistency of concrete can be more closely controlled. Experiments indicate that the compressive strength of concrete made of a given grading of aggregate, varies inversely as the consistency of the mix. By the use of the inundation method of proportioning sand, it may be possible to specify concrete by its strength rather than by its volumetric proportions. To my knowledge no practical adaptation has yet been made for using this method in actual construction, although there are no serious obstacles in the way of doing so.

The use of bulk cement has not been developed to the extent it could be. The standard sack of cement has been used so long in proportioning aggregates that the custom seems fixed. With storage bin facilities, it is used successfully on both the central proportioning and central mixing plant types.

CURING

In the curing of the slab, it is general practice to maintain moisture and temperature factors as nearly as may be at normal conditions. The top of the subgrade is kept moist, so that soil will absorb as little moisture from the concrete as possible. To retard evaporation and to reduce internal stresses, canvas canopies are placed over the concrete surface after finishing, or as soon as the concrete is sufficiently hard, the surface is covered with water or moistened earth. These precautions make the rate of curing more uniform. The addition of reinforcement to the slab has no beneficial action in curing, as during contraction the steel has formed no bond with concrete.

SPECIAL EQUIPMENT

Considerable progress has been made in the development of the finishing machine. It is a labor saving device and I might say a life saving device, to humanely express its improvement over hand finishing. By the use of such a machine, a drier and stronger concrete can be properly laid. The tamping action is particularly effective, tending to make a denser concrete and to flush grout to the surface for a smooth finish.

The design of the pavement is not within the scope of this paper. There are certain details of design, however, that affect construction methods, not materially, but sufficiently to cause the builder some wonder as to how much work they will entail. I mention but a few of the most noteworthy developments. The central longitudinal joint is generally placed to prevent a long crooked longitudinal crack. It is claimed that it increases about four times the beam strength of the half slab, acting as a beam. Steel dowel bars are placed transversely across the joint to act as tie-bars. The placing of the stiff dividing joint and the steel dowel bars in advance of the placing of concrete has not proved any drawback whatever in the efficient prosecution of the work. Systems of steel reinforcement of the slab are now so fabricated that their placing above the subgrade does not interfere with other operations. The shape of the cross section on the bottom of the slab or the top of the subgrade has not been standardized. This detail works no particular hardships on the builder, however, as far as methods are concerned.

In regard to details of equipment, some specifications require the use of steel side forms exclusively. This is quite necessary where a machine finisher is used. With the tendency towards concrete of firmer consistency, mixers are provided with accurate water gauging devices. Timing devices are also considered necessary. The boom and bucket system of distribution after discharge from the mixer is favored, as a drier mix can be used satisfactorily and segregation of aggregates prevented.

With the opening of the pavement to traffic, the traveler is at once impressed with its riding qualities. The smoothness of finish, its freedom from unevenness, are factors of prime importance to him, momentarily overshadowing the importance of the strength of the pavement. In specifications, the limits of variation from a true surface are being drawn still closer. Expansion joints, where placed, must have their top edges truly flush with the adjacent concrete surface. Every detail of construction in fact is given painstaking care.

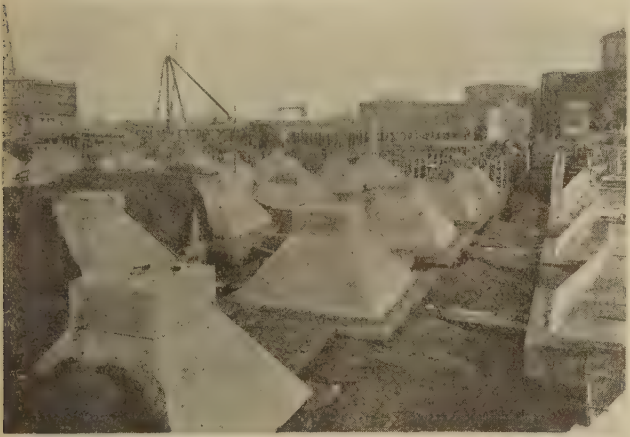
In conclusion, a summation of the most striking developments that affect the methods used in this type of pavement would include the tendency towards the mechanical perfection of labor saving devices, plant coordination, security of material supply and large capital investments with a well trained and efficient organization.

Precast Piers and Arches for Shipping Terminal, San Francisco

The accompanying illustrations show the unique features of the concrete substructure now being constructed along the San Francisco water front by Healy Tibbets Construction Co. for the California State Harbor Board. The project is known as the China Basin Terminal. The building will be of reinforced concrete 812 ft. long and 6 stories high, and will serve as a combined transit shed and warehouse. It will be the first multiple story warehouse on the Pacific Coast, if not in the United States, located immediately adjacent to deep water, with a berth which will permit of docking large ocean steamships. The cost of the substructure will be about $950,000 and of the entire terminal approximately $2,300,000.

The main sea wall is of a type which has not previously been used in San Francisco. It consists essentially of a series of precast reinforced concrete caissons which are set approximately 15 ft. apart in the clear, 22 ft. center to center, the space between adjacent caissons being closed with precast curved curtain walls. The caissons are 7.5 ft. wide, 20 ft. wide at right angles to the axis of the wall, and from 54 to 57 ft. deep below the level of the deck.

The caissons were built with three compartments with one end cast solid. Extra precautions were taken to insure an impermeable concrete so that the ends of the caissons could be bulkheaded and the caissons floated to place. There were 40 caissons used in the entire sea wall. For the purpose of helping place the caissons in the proper position and for the purpose of filling them with concrete after they were placed, a false work was built out over the line of caissons carrying three steel rails, over which ran a traveler with flanged wheels. This was used in setting the caissons, in connection with a floating pile-driver rig and in placing crushed rock used for the foundation of the caissons. Another traveler, with flanged wheels, was used in placing the concrete in the caissons after they had been placed in position.



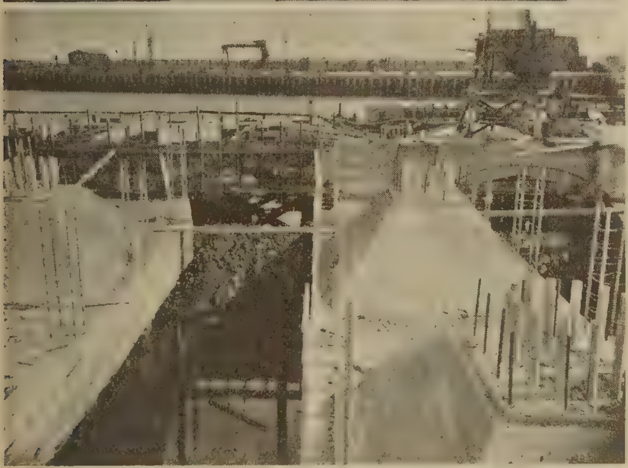
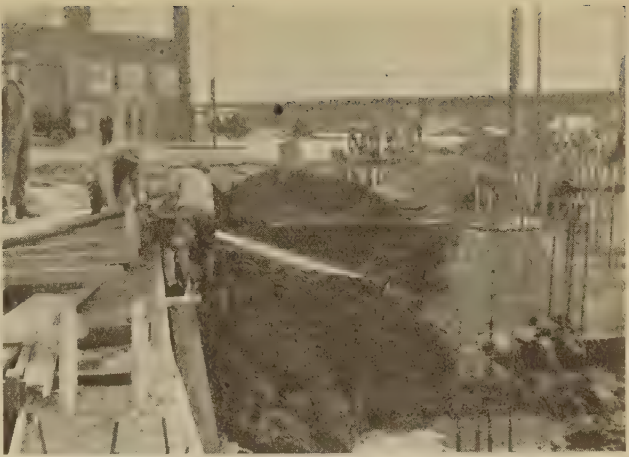


Fig. 1—Concrete Footings for the Building, with the Sea Wall in the Distance. Note How Area is being Filled in with Sand

Fig. 2—Showing How the Top of the Caisson is Tied Back to the Foundation Piles by the Concrete Tie Beam



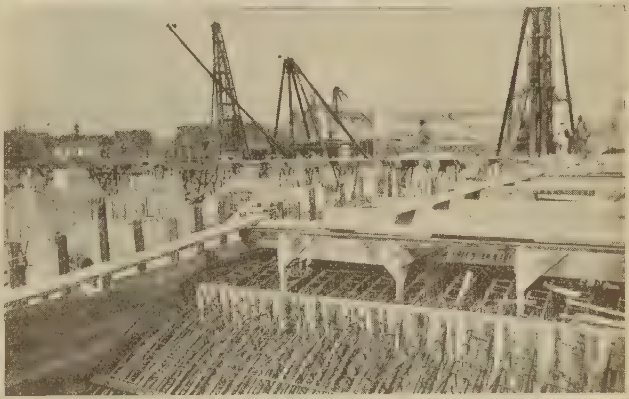


Fig. 3—Sluicing Sand Into Place Under the Concrete Tie Beam

Fig. 4—In Foreground Can be Seen Reinforcing Steel for Concrete Arches Which Will Carry the Wharf and Railroad Track

Motor boats were used in towing the caissons to a point where they were to be lowered into the excavation made for them. The open ends of the caissons were closed with heavy timber bulkhead before being launched. There were holes in the bulkhead so that water could be pumped into the three compartments. When all was ready to sink the caisson, water was pumped into one of the compartments which started it sinking and at the same time turned it endwise so that it could be gotten into the right position with the major axis normal to the line of the wall. As the end of the caisson started to sink, the bulkheaded end was raised by a floating pile-driver rig, and water was pumped into all three compartments causing the caisson to slowly sink into place on the prepared bed. The caissons were cast with large U-bolts in the end so that they could be handled easily. The traveler was equipped with chain hoists which were hooked into the U-bolts, greatly facilitating the lowering of the caissons.

The wooden bulkhead was removed from the end of the caisson after it was in position, leveled and properly braced, and then the concrete bulkhead was knocked out by dropping a heavy steel shaft down through the caisson. From 15 to 18 piles were then driven into the bottom of the caissons to prevent lateral movement of the caisson due to the heavy sand fill behind the sea wall. The caisson was then sealed to a height of 12 ft. with Tremie concrete, and after the Tremie concrete was properly set the water was pumped from the caisson and all laitance cleaned from the surface of the underwater concrete. The caisson was then filled with concrete to its top. The concrete was mixed on a barge which could be moved along the line of caissons as the work progressed.

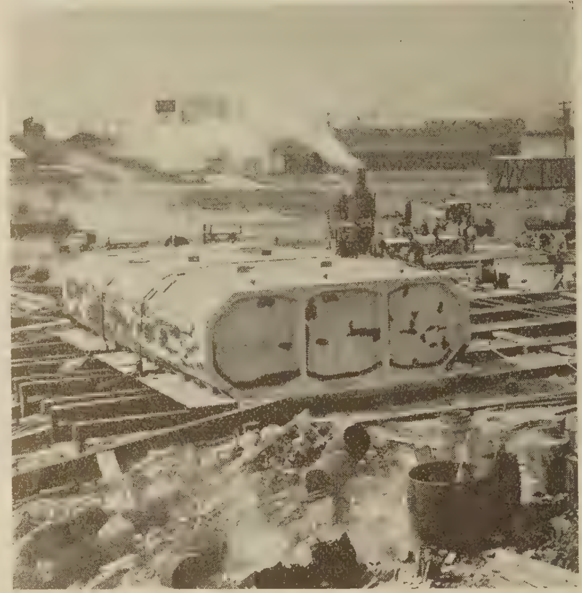


Fig. 5—Precast Concrete Caisson Ready for Launching. The View Shows the End That is Cast Solid

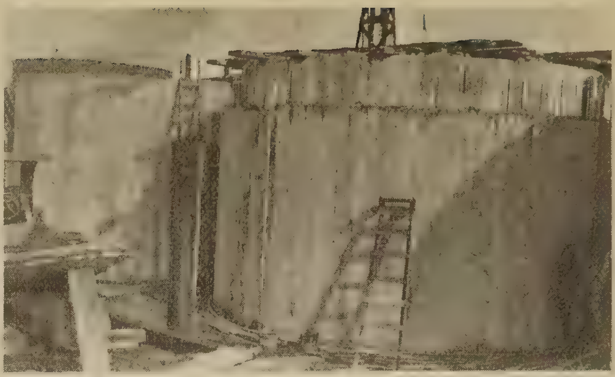
The spaces between the caissons were closed by reinforced precast curtain walls which were curved so as to act as vertical arches. The forms were set so that the arches stood in a vertical plane during casting, and were not handled until at least 28 days after pouring. Each arch was provided with large U-bolts for handling and placing.

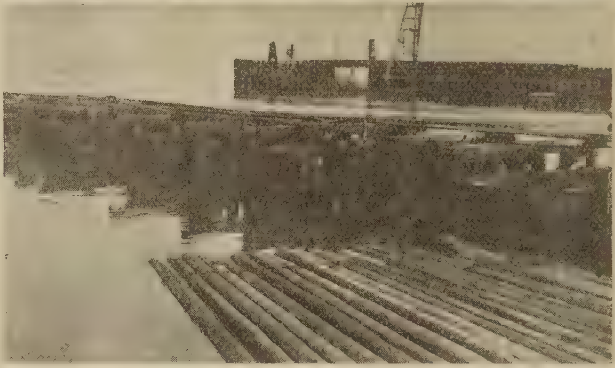
The seasoned concrete arches were loaded onto barges and towed along the caissons and set by lowering them between adjacent caissons with floating pile-driver rig. After rock fill was placed to the proper height on both sides of the curtain wall, the joints between the arches and caissons were grouted with 1:2 mortar. For convenience in placing the arches between the caissons to form the curtain wall, and to insure perfect alignment and solid construction, the side edges of the arches and the corresponding edges of the caissons were formed to make a tongue-and-groove joint.

Two purposes are served by the caissons and arches: they not only act as a sea wall (the area back of the sea wall being filled in with sand to a height of from 42 to 45 ft.) but they support a wharf carrying railroad tracks. This wharf is of concrete and will be 1000 ft. long.

The caissons carry a series of reinforced concrete arches which in turn carry the wharf and railroad tracks.

To overcome the tendency of the top of the caissons to move outward due to the lateral thrust of the back fill, the top of each caisson is tied back to the foundation piles of each bent by a concrete tie beam 12 ft. wide x 3 ft. deep and reinforced with 14 1¼-in. bars. The method of tying back to the foundation piles of each bent by the concrete tie is shown in Figs. 1, 2 and 3. These illustrations also show the foundation for the building proper. Clusters of piles driven through the sand fill and into the underlying hard pan directly support the concrete footings. A total of 5,400 piles was used in this part of the work. From 23 to 28 piles are used in supporting each of the heavy footings.





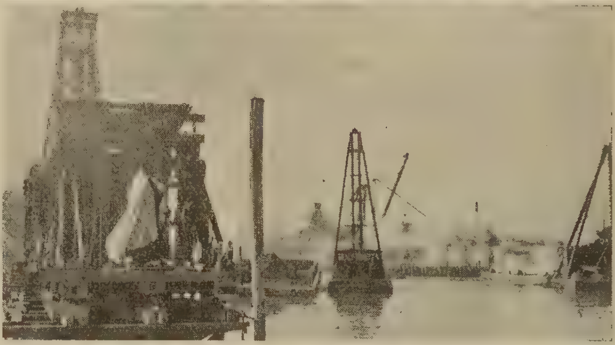


Fig. 6—Showing Precast Curved Curtain Walls on Barge

Fig. 7—View Showing a Number of the Caissons in Place

Fig. 8—Showing Precast Curtain Arch in Distance at Right. At Left is Shown the Falsework and the Traveler Used in Placing Caisson and for Placing Arch for Caisson Foundation

The first floor over the outer half of the building is of flat slab construction and is supported by the columns footings, but the inner portion of the floor is to be laid directly on the sand fill.

Fig. 2 shows some of the piles supporting the footings. This also shows arches for supporting the wharf and railroad track. Fig. 3 shows the method of sluicing sand under the section connecting each caisson to the concrete tie beam.

How better to control the quality of concrete on the job? How are you doing it? Tell the other fellow through this magazine.

Reinforced Concrete Railway Ties

After *Der Bauingenieur*

By E. Lee Heidenreich

The average annual demand for railway ties in the world, as of 1911, basing the demand on a life of 15 years per tie is reviewed by Dr. Engr. W. Petry in the first 1923 number of *Der Bauingenieur*, as follows:

Germany	5,600,000
England exclusive of colonies	3,400,000
France	4,500,000
Italy	1,600,000
Switzerland	300,000
Holland	280,000
Spain	1,500,000
United States	36,000,000

Dr. Petry attributes the slow adaptation of reinforced concrete to railway ties to the difficulties encountered in the rail fastening and in the elasticity and lasting quality of the cushion pads under the steel rails. These objections have, however, been largely overcome during the past few years, particularly on account of the great lack of wood and steel in Germany since the war, and he sees the probability of a universal use of concrete ties in the near future.

In the above table side tracks are not included, nor the demands of any of the states in South America, Africa, Australia or Asia, so the real present demand is far in excess of the one stated.

Iron ties, which are used to a considerable extent in Germany, are more costly than concrete ties, and as 69% of the wooden ties used in Germany are imported, the reinforced concrete ties have been attracting close attention for several years.

The "Asbeston" tie has been tried since 1909. It is a monolithic admixture of asbestos and cement, with concrete of other aggregate, where the inner part is asbestos concrete. "Asbeston" may be sawed or drilled like wood, is elastic and bonds itself to steel like cement concrete.

Figs. 1-3—Original Installation of Ickes Ties

In tests as to the pulling strength of spikes or screws imbedded in asbeston ties compared with pine ties, the asbeston ties were shown to be far stronger.

These ties have been used in Germany, Sweden and Hungary since 1913 and in 8 or 9 years of observation have proved satisfactory for use in new work. The only trouble found was that in a few cases the asbeston which acts as cushion pads was wearing down, so that the rail cut into it, or that the monolithic action between the asbeston and the cement concrete was defective. Both of these faults were traced to faulty manufacture.

Owing to the cost, the amount of asbeston concrete lately has been reduced to a mere cushion pad and surrounding the rail fastening device.

After theoretical and practical investigation, it was found that the economical length of a tie was one and one-half times the distance between rail centers, and that the tamping should be omitted under the center two feet of the tie—between the rails.

At present, considerable stretches of track have and are being laid, both for steam roads and street car service.

Actual Tests on the Ickes Concrete Tie

By E. Lee Heidenreich

The Ickes concrete tie, a full description of which was published in May, 1921, Concrete, has now been under service in the main track and a side track on Kansas City Southern R. R. at Kansas City, Mo., for a matter of 18 months.

The main track is located over an old swamp in a curve, and had an 80-lb. rail without creepers.

Fig. 1 shows the ties on August 21, 1921. Only 12 ties were laid, three under each rail joint. These ties were of a convex shape on the underside, which at the different speeds of the train in the curve made them rock so as to break off or spall off the corners at the joints.

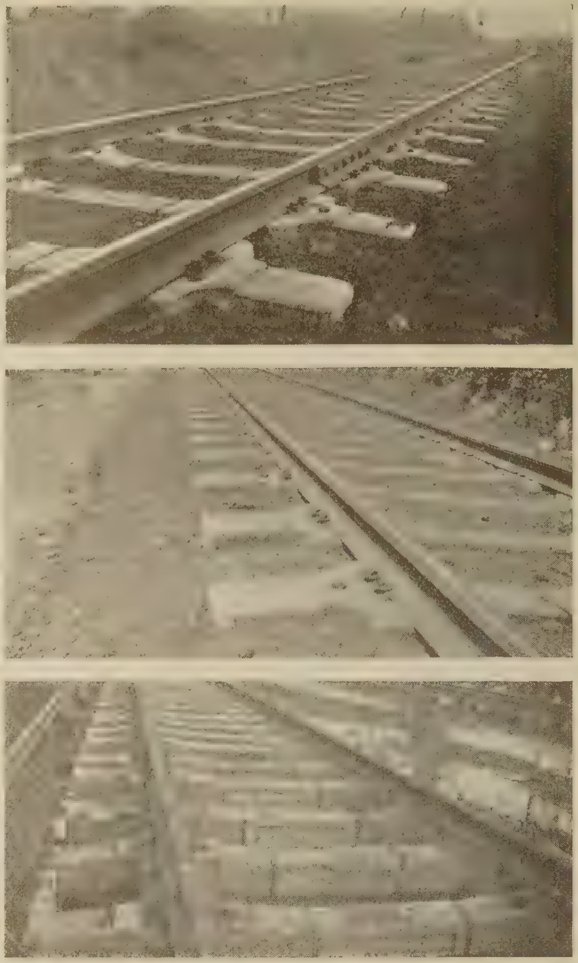
These corners were then reinforced in the new ties and the underside made straight. Six kinds of cushion pads were placed for testing purposes under different rail supports. After breaking a number of straight-bottom ties, which inadvertently had been placed in the cupped holes, where the first ties had been laid—without retamping—one and a half panels were finally completed and photographed Nov. 2, 1921, as shown in Fig. 2. The tie bar of some of the ties was ¾ in. x 2 in. instead of ⅜ in. x 2 in., and these spalled off at joints, but since this was remedied none of the outer tie pieces have broken.

Fig. 4 shows the ties on July 15, 1922, in perfect order.

On Oct. 30, the rail was changed to 90 lbs., and Fig. 5 shows the track just before it was moved bodily over to a new sidetrack for further observation. The rail fastening was found faulty to the extent that it could not be taken off and replaced in the 45 minutes between two trains, so oak ties were thrown into the new track to permit changing the rail fastening.

A new rail fastening has been arranged by inserting the bolts from underneath, as the ties are laid, with adjustable rail clips to hold the rail. Another method is being tested: that of screwing the bolts from above into threaded sleeves cast into the ties.

The best cushion pad is made from laminated felt layers soaked in a hydrocarbon solution and then subjected to a pressure of 450 lbs. to the sq. in.



FIGS. 4-6—ICKES TIES IN SERVICE

before being placed under the tie plate.

Instead of 20 ties to the rail, only a maximum of 12 are required, which of course reduces the apparent excess of cost of a concrete tie over a creosoted wooden one—in addition to the reduction due to the longer life. The quiet running over these ties is very noticeable, and only one-third of the maintenance tamping has been required.

Fig. 6 shows the concrete track being shoved over to the new location, and shows plainly that only a few of the center pieces were broken by spalling, on account of the ¾-in. x 2-in. tie bars, and that only the outer pieces were replaced at that time.

The annual amount of concrete ties required in the world to replace wooden ties as fast as they are being taken out, figuring one concrete tie for each two wood ties would be approximately as follows: (Based on the railroad mileage taken from Bureau of Economics for 1917)

Belgium	5,477 miles	547,700 Concrete ties
Japan	39,855 "	3,985,500 " "
Sweden	9,297 "	929,700 " "
Spain	9,538 "	953,800 " "
Union of So. Africa	11,237 "	1,123,700 " "
Italy	11,337 "	1,133,700 " "
Brazil	16,555 "	1,655,500 " "
Australia	19,555 "	1,955,500 " "
Argentine Republic	22,310 "	2,231,000 " "
Canada	30,788 "	3,078,800 " "
Mexico	15,840 "	1,584,000 " "
France	31,958 "	3,195,800 " "
British East India	35,277 "	3,527,700 " "
Germany (Approximate)	30,000 "	3,000,000 " "
United States of Amer.	259,555 "	25,955,000 " "

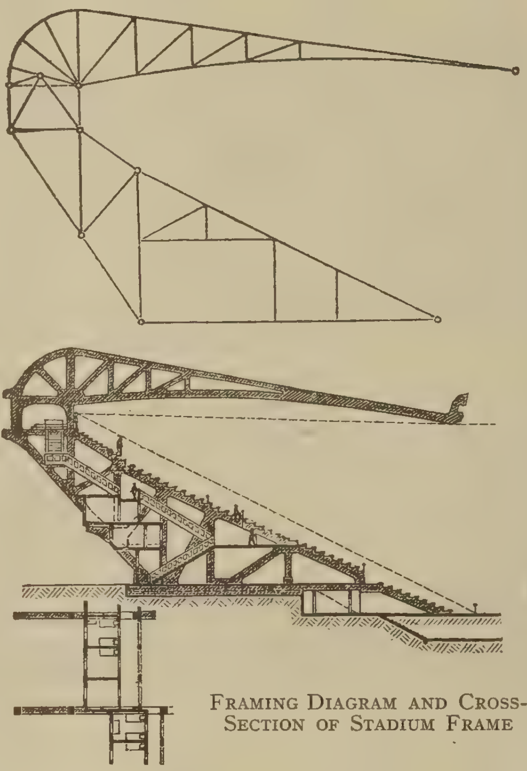
These figures should warrant a very serious consideration of a very important addition to the concrete industry.

Stadium for 1924 Olympic Games

From Beton u. Eisen

A gigantic stadium for 80,000 people giving every person an unhindered view, has been designed by Guillaume Tronchet and Henry Lossier, the well known French architects and engineers, for the Olympic games in Paris in 1924.

The accompanying figure shows diagramatically the static frame, and in another view the actual cross section of the frames. These frames are 32 ft. 8 in. on centers, and there are 80 such frames.



FRAMING DIAGRAM AND CROSS-SECTION OF STADIUM FRAME

The highest point of the frame is 76 ft. 6 in. above the arena, and the overhang of the roof is 130 ft. with a neat clear distance of 65 ft. above the pit.

All columns or other obstructions to the view are obviated in the design. The space underneath the structure serves for restaurants, hospital, smoking rooms, storage and garages.

The statical calculations assume a wind pressure from within as well as without of 50 lbs. per sq. ft. and 20 lbs. from below under the roof, a snow load of 13½ lbs. on the overhanging roof, as well as a live load in general of 115 lbs. per sq. ft.

If you have found a better way of doing a thing—exchange the idea through CONCRETE for other men's "better ways."

Concrete Compression Tests

By H. C. Badder
London, England

The writer is closely engaged in the inspection of concrete work of all kinds and is, of course, deeply interested in any improvements in methods of improving quality.

Concrete has published many valuable papers on the various aspects of concrete making for all purposes, from blocks and other pre-cast work, to details of large mass concrete work, and also laboratory tests results.

It is the latter that is interesting at the moment. Of the many reports published from the Standards Bureau and other testing stations, it has been noticeable that the figures given for tensile and compression tests are not very high.

Why this should be so is difficult to explain. It cannot be due to any difference in the quality of portland cement manufactured in the United States or Europe, or in the skill of the testing engineers, and the aggregates can hardly vary if they are clean and well-graded.

To illustrate the difference the following table of test results is given. These tests were made in January this year in London (England) by testing engineers of the highest standing, to show the results gained by the use of a certain concrete waterproofer in a series of concrete proportions.

The waterproofer may be ignored here; it is the very high values of the compression tests that call for attention.

It is now a maxim that concrete mixes cannot be stronger than the cement mortar they are made with. That means, if 1 part of standard portland cement and 3 of standard sand reach a compression of 4,000 lbs. in 28 days, then a certain proportion of coarse aggregates may be used with that mortar to produce concrete of the same strength, but there is a critical point where further increase of aggregates will reduce the strength below 4,000 lbs. per sq. in.

The table given is not abnormal, as the same testing engineers are able to get a compression test of 1 part portland cement to 3 of standard sand and reach 5,200 lbs. as lowest and 6,250 lbs. as highest, in a series of 6 cubes at 28 days.

Summary of results of tests to determine the crushing strength of 6-in. concrete cubes with and without waterproofing. Materials, Gurnsey Granite, Thames Washed Sand, Tunnel Brand cement and 7% of proofing to portland cement.

AVERAGE OF 3 CUBES

Mixture	Weight Lbs.		Crushing Strength Lbs. per square inch	
				Tons
1:1½:3	20.27	....	7460	479.5
1:1½:3 7% proofing	20.05	....	7570	486.9
1:2:3	19.72	....	7020	112.4
1:2:3 7% proofing	20.05	....	7050	113.1
1:2:4	19.70	....	5110	328.4
1:2:4 7% proofing	20.02	....	5930	95.30
1:2½:4	19.59	....	5930	365.7
1:2½:4 7% proofing	20.22	....	5280	84.79
1:3:5	19.42	....	3120	200.6
1:3:5 7% proofing	19.51	....	4450	285.9
1:3½:5	19.64	....	4000	257.0
1:3½:5 7% proofing	19.63	....	4140	266.0
1:3:6	20.00	....	3200	205.0
1:3:6 7% proofing	19.62	....	3840	246.7
1:4:6	19.37	....	2550	164.2
1:4:6 7% proofing	19.57	....	2850	183.2

Age of cubes 28 days.

It may be promptly acknowledged that the bulk of concrete work done in England has a low compression value, just as there is in other countries using concrete, owing to the general lack of real knowledge and skill of some workmen and their employers.

Taking the really technical use of concrete for

Results of tests to determine the crushing strength of 6-in. concrete cubes with and without waterproofing. Materials, Gurnsey Granite, Thames Washed Sand, Tunnel Brand Portland Cement and 7% of proofing to Portland Cement.

Mixture	Weight Lbs.	Dimensions Inches	Crushing Strength Lbs. per square inch	
				Tons
1:1½:3	20.18	6.00 x 6.04 x 6.10	7270	467.5
	20.54	6.02 x 6.8 x 6.10	7640	491.3
	20.10	6.00 x 6.4 x 6.06	7460	479.7
		Average	7460	479.5
1:1½:3 7% proofing	19.72	6.00 x 6.00 x 6.04	7620	490.0
	20.30	6.00 x 6.02 x 6.14	7300	469.4
	20.12	6.00 x 6.02 x 6.10	7800	501.5
		Average	7570	486.9
1:2:3	19.69	6.00 x 6.04 x 6.10	7300	117.2
	19.66	6.02 x 6.08 x 6.10	6810	109.3
	19.80	6.00 x 6.04 x 6.06	6950	111.6
		Average	7020	112.4
1:2:3 7% proofing	19.72	6.00 x 6.00 x 6.04	6940	111.4
	20.30	6.00 x 6.08 x 6.14	6910	110.8
	20.12	6.00 x 6.02 x 6.10	7300	117.2
		Average	7050	113.1
1:2:4	19.85	6.00 x 6.00 x 6.06	5270	338.9
	19.92	5.98 x 6.03 x 6.06	4990	320.9
	20.22	6.00 x 6.02 x 6.10	5060	325.4
		Average	5110	328.4
1:2:4 7% proofing	19.80	6.00 x 6.00 x 6.05	5910	94.98
	20.10	6.00 x 6.05 x 6.04	5920	95.14
	20.15	6.00 x 6.00 x 6.14	5960	95.78
		Average	5930	95.30
1:2½:4	19.95	6.00 x 6.04 x 6.04	5460	351.1
	19.66	6.00 x 6.02 x 6.05	5630	362.0
	20.06	6.02 x 6.00 x 6.10	5970	383.9
		Average	5690	365.7
1:2½:4 7% proofing	20.00	6.04 x 6.02 x 6.06	5210	83.73
	20.42	6.00 x 6.05 x 6.10	5330	85.48
	20.25	6.02 x 6.02 x 6.10	5300	85.18
		Average	5280	84.79
1:3:5	19.26	6.00 x 6.00 x 6.04	3340	214.8
	19.40	6.04 x 6.00 x 6.02	2910	187.1
	19.60	6.00 x 6.00 x 6.06	3110	200.0
		Average	3120	200.6
1:3:5 7% proofing	19.52	6.00 x 6.04 x 6.10	4430	284.8
	19.66	6.02 x 6.00 x 6.08	4310	277.1
	19.35	6.00 x 6.02 x 6.04	4600	295.8
		Average	4450	285.9
1:3½:5	19.52	6.02 x 6.02 x 6.08	4110	264.3
	19.60	6.00 x 6.04 x 6.08	3890	250.1
	19.80	6.02 x 6.02 x 6.10	3990	256.5
		Average	4000	257.0
1:3½:5 7% proofing	19.94	6.00 x 6.04 x 6.10	4040	259.8
	19.75	6.00 x 6.04 x 6.10	4080	262.3
	19.20	6.00 x 6.00 x 6.05	4290	275.8
		Average	4140	266.0
1:3:6	19.60	6.00 x 6.00 x 6.00	3270	210.3
	19.88	6.00 x 6.00 x 6.10	3360	216.0
	20.52	6.05 x 6.05 x 6.10	2960	190.3
		Average	3200	205.0
1:3:6 7% proofing	20.05	6.00 x 6.00 x 6.10	3960	254.6
	19.42	6.00 x 6.00 x 6.25	3710	238.6
	19.98	6.00 x 6.00 x 6.15	3840	246.9
		Average	3840	246.7
1:4:6	19.15	6.00 x 6.00 x 6.00	2720	174.9
	19.25	6.00 x 6.00 x 6.10	2470	158.8
	19.12	6.00 x 6.00 x 6.05	2470	158.8
		Average	2550	164.2
1:4:6 7% proofing	19.50	6.00 x 6.00 x 6.05	2850	183.2
	19.48	6.00 x 6.00 x 6.00	2780	178.7
	19.73	6.00 x 6.00 x 6.15	2850	183.2
		Average	2850	183.2

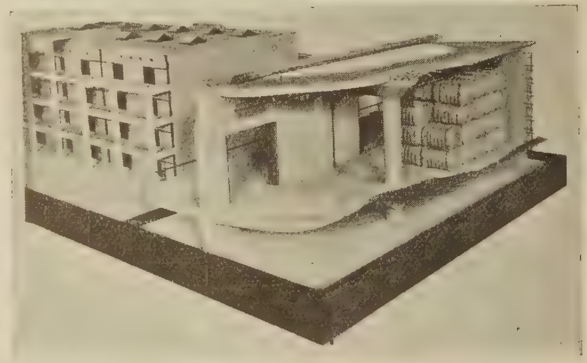
Age of Cubes 28 Days

important structures, it may be said there are concrete engineers in England who are not satisfied if their concrete does not reach over 5,000 lbs. in compression tests of 1:2:4 mix at 28 days for cubes taken in field work.

A recent compression test of 1:2:4 cubes taken from field work and kept in sea water and in air alternately every three days, crushed at 6,015 lbs. per sq. in. at the end of the year's test.

It is certain that the cement manufacturers can make a cement far above the standard required by the standards authorities, and their specifications will, no doubt, be amended in the near future.

In the meantime, some of your technical readers may be able to explain why some testing engineers produce lower compression values on the average under what must be similar conditions to those recited in the accompanying table.



Sectional View of Standard Four-Story Warehouse Shows the Most Economical Method of Storing Cotton

Traveling Exhibit Shows How to Store Cotton

Through the new policy of the Federal Department of Agriculture, students at the leading agricultural colleges in the cotton growing states have had some very definite instruction during the last few months on the proper methods of handling and storing cotton. Traveling exhibits have made a circuit of these colleges. Carefully planned models have been prepared embodying the correct principles of reinforced concrete construction. With these models before them, government experts have explained to the students the prime importance of storing in fireproof warehouses, this leading southern crop. The exhibit consists of panels showing the official cotton standards, the process of cotton manufacturing and testing, country damage of cotton and cotton handling and marketing. "Get a crop and save it" has been the slogan of the demonstrators.

Effect of Calcium Chloride on Strength of Cement

The effect of the addition of calcium chloride on the strength of portland cement was determined by C. R. Platzmann as described in *Chemical Abstracts*, when calcium chloride to the extent of 2.4% to 5% was added with the water in mixing the mortar, to hasten hardening and prevent cracks due to shrinking. The temperature of setting was determined by means of Killig's apparatus. Although this indicated only part of the heat generated, the relative temperatures obtained were interesting. The tests were carried out with a common cement and with a slag cement. The average tensile and crushing strengths at the end of various periods of time and for various percentages of calcium chloride were tabulated. The addition of calcium chloride was found to improve the constancy of the volume and increase the generation of heat during setting. The cement is less readily attacked by various gases which in the presence of water form sulfurous and sulfuric acid.

Browerville Creamery

The picture is of the Browerville creamery, designed by Ernest Kahlert, Browerville, Minn.; L. A. Borgert, contractor. The walls are of concrete block covered with Kellastone stucco, and the floors and roof are of reinforced concrete.

The building is 40 x 80 ft., and two stories high. The first floor is divided into five rooms—office, cooler, work room, boiler room, and receiving room. There is a basement 16 ft. x 38 ft. under the front part of the building, which is divided into two rooms—one is used for the ice machine and the other for storage. The second floor is not divided into rooms. Stairs lead from the office to the second floor and from the work room to the basement. A freight elevator is operated between the basement and the second floor.

The walls of the building are of the double concrete block wall construction, 12 in. thick, containing a 4-in. continuous air space. The walls are tied together with heavy galvanized iron ties, spaced about 12 in. apart on each course of blocks. The blocks for the walls were made on a Helm block and brick press, the dimensions are 4 in. x 8 in. x 23½ in. The pilasters, string-courses and cornice are concrete blocks. Two pilasters on each side and one in front are made to form flues 12 in. x 16 in. in size, that are used for ventilation. The floors and roofs are of reinforced concrete, of the ribbed slab construction. The floors and roofs are supported by the side walls and by columns and girders through the center of the building. Kellastone Stucco has been used on all the exterior walls of the building. A dash-gray in color was used on all the wall surfaces, except on the pilasters, string-courses, cornice, etc., which were left in the white finish.

Browerville Creamery of Concrete Block and Stucco

One-Arm Man Runs Mixer

The George R. Wade Construction Co., Kenosha, Wis., employed a one-armed man to operate a Smith paver on a four and a half mile road job between Lake Villa and Antioch, Ill. The mixer was equipped with a boom and bucket distributing device and with the customary equipment of loading skip, water tank and power-operated discharge. The machine was controlled from five closely grouped operating levers and three pedals, and the operator, in spite of his handicap, put concrete onto the subgrade as fast as material was available. He operated the traction brakes and the power discharge mechanism with his feet, and while controlling the loading skip with his single arm, operated the water tank lever with one knee. Trucks were used for charging the mixer and the material was hauled from a central proportioning plant located with the camp on the shores of Loon Lake. Water for the mixer and for curing the freshly laid concrete was pumped from this lake.

Labor Shortage Agitation

The Building Officials' Conference, assembled at Toledo, Ohio, April 24, 25, 26, in its ninth annual meeting, adopted resolutions concerning the deplorable labor shortage, to the effect that: Whereas the lack of skilled labor menaces the peace and advancement of the nation and bears directly upon members of this conference, and is caused by the fact that apprentices are not now being trained, Therefore be it resolved that members throughout the country do everything in their power by propaganda, personal endeavor and other means, to correct the condition.

New Books

Popular Mechanics' Concrete Handbook No. 1. Size 6½ in. x 9½ in.; 90 pages; illustrated; Price, 50c; Popular Mechanics Press, Chicago, Ill.

This book arranged to meet the needs of concrete workers for the home, farm and factory, contains considerable information of interest to the professional concrete worker. It is designed to give clear directions on a great variety of work, especially suited to the needs of the amateur. The information contained in the 173 articles which go to make up the book is written in an understandable way, giving step by step instructions for doing concrete work without going into the discussion of why the methods described are adapted to the work for which they are recommended.

The Dow Spiral Slide Fire Escape

The Dow spiral slide fire escape made by the Dow Co., Louisville, Ky., consists of a smooth galvanized spiral slide enclosed in a cylinder 5 ft. in diameter, equipped with automatic entrance and exit doors. The escape is constructed entirely of steel.

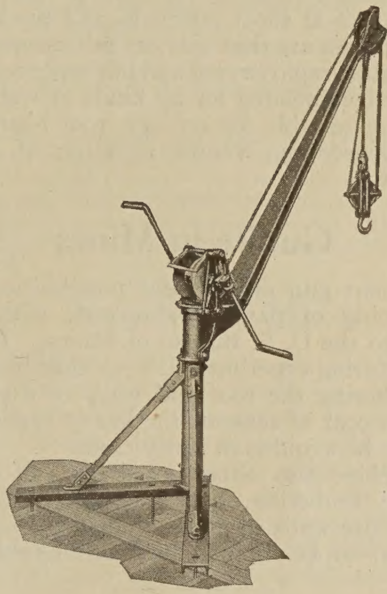
Among the special advantages claimed for this type of fire escape is that it has no steps, thereby averting congestion and falling. The occupants of a building simply slide to safety with neither mental nor physical effort. It is wholly enclosed, and protected from rain, snow, smoke and fire.

The spiral slide escape is placed upon a foundation constructed of concrete, consisting of a center pier 12 in. square and 15 in. high and an outer ring 6 ft. 1 in. outside diameter extending below the frost line where placed outside of the building.

When placed inside the building, the Dow spiral slide escape takes up very little floor space.

Barrett Portable Derrick

The accompanying illustration shows the Barrett portable derrick for one-man operation and having a capacity of 2000 lbs. This derrick is designed for use wherever loads are to be hoisted a few feet or several hundred feet. It is made in two major parts: a beam which includes the hoisting mechanism and a bore. One man can carry either section and install it alone.



It is recommended for use in handling lumber, brick, mortar, roofing materials or anything heavy and bulky. It can be used for loading trucks, handling heavy parts in the shop, or attached to industrial tractors. The Barrett portable derrick is made by the Barrett-Cravens Co., Chicago, Ill.

Evinrude Pump Improved

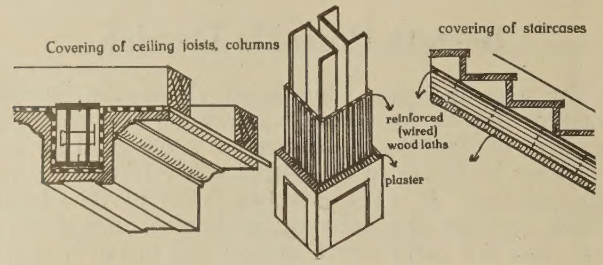
The Evinrude Motor Co., Milwaukee, announces a recent improvement in the bearing equipment of its centrifugal pump, many of which are now used by contractors, engineers, municipalities, bridge builders, dredging companies and public service corporations.

To support the pump shaft at the lower end, a ball thrust bearing has been provided. This bearing supplants the lignum vitae plug heretofore used. After a six months' test it has been found that the ball bearing greatly increases the life of the lower bearings and also makes the pump operate more freely and effectively. This improvement is of special value because it can be installed in those pumps now in the hands of users.

February and March issues of *The Idealist*, published by the Ideal Concrete Machinery Co., Cincinnati, Ohio, call special attention to the new home of the company at 5000 Spring Grove Ave., Winton Place, Cincinnati. The February number gives a little history of the rise of the Ideal company, which was organized back in 1904 at Auburn, Ind. The new factory is built of Ideal concrete block and Ideal tile.

Reinforced Wood Lath

The accompanying illustration shows some of the various uses to which reinforced wired wood laths for partitions and ceilings, etc., are used in Germany. Reinforced wired wood laths are put out by Steegmuller & Sohne, Stuttgart, Germany.


Covering of ceiling joists, columns
covering of staircases
reinforced (wired) wood laths
plaster

The material consists of wood laths which are interlaced with wire at short intervals, and the advantages claimed for them are that they are self carrying without joints, nailable, rapid drying and of simple construction. They are recommended for all kinds of wall construction and are suitable for ceilings, roof boarding, door casings, wainscoting, vaults, covering of fixed sills, columns, etc.

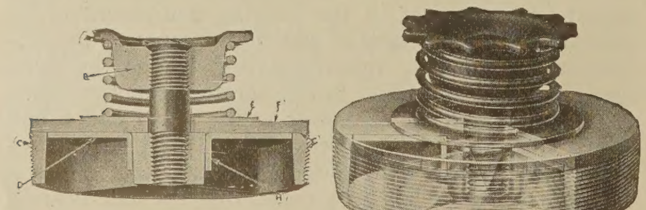
Gunite in Mines

The cement gun offers great possibilities in mines for the lining of passageways, etc., with concrete, according to the U. S. Bureau of Mines. The Bureau has found during experimental work that by protecting from weathering the roof and walls of a passageway with a thin coat of cement, the heavy expense of timbering may be avoided in many cases.

The machine also offers possibilities of use in fireproofing of timbering, board stoppings, and in the erection of fire walls in places difficult of access, since the material can be pumped for a considerable distance.

Advance in Pump Valves

A new pump valve has been evolved by the Worthington Pump and Machinery Corp. of New York, which is known as the Worthington Seal Valve, for use when conditions are too hard for the ordinary form of valve now in standard use. It is claimed for the new seal valve that it assures absolute tightness when closed, because the rubber used is flexible and will always seat perfectly both at the hub and outer rim, its inner and outer seats.

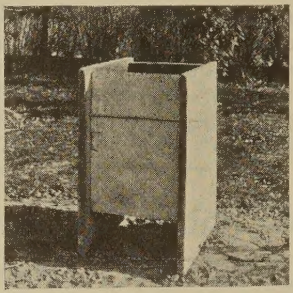


The special new feature which it is claimed makes this valve so good for hard service is the so-called "bottom plate." This is in effect a middle seat for the rubber valve proper. When the valve is closed this middle seat carries the entire load and prevents the rubber seal from cutting on the seats or ribs. This bottom plate moves up and down with the rubber and acts not only as a middle seat, but this middle seat is movable with the rubber and helps to keep the valve in shape even when open. All mechanical functions requiring strength and wear resistance are cared for by the metal parts, the rubber acting only as a seal against leakage.

Although this valve is designed to be especially suitable for severe and unusual conditions, it is available for ordinary pumping conditions.

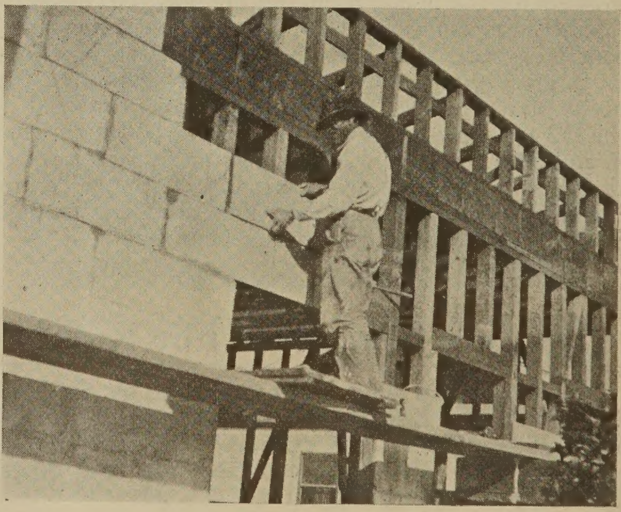
Rubbish Burner

The Porete incinerator is a new products specialty of the Porete Manufacturing Co., Newark, N. J., is built of light-weight concrete, well-designed, and fits into any suburban garden. Exposure to fire, gases and all kinds of weather is said not to affect either its serviceability or its appearance. The incinerator (shown in illustration) gives plenty of air from underneath to kindle the fire, and is covered on top with a wire netting, easily removable, to prevent the burning rubbish from being carried away. Price of the burner is $15.00—shipped knocked down.



Concrete Boards Replace Lath and Sheathing

Andrew Haller, San Pedro, Calif., has just completed a store building on which concrete boards, about 1 in. thick, and 1 in. x 232 in., were molded and nailed on the joists. These were made of a 1:4 mix in wooden molds with chicken wire reinforcement. Before the slabs hardened, holes were made for nails which were to secure the boards to the studding. Where the boards came together in the middle of a stud, washers were used with the nails to secure the two ends of the slab. These boards are nailed both outside and inside the walls, and plastering applied.



Concrete Boards Being Applied on Studding

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 1807 East Grand Boulevard, Detroit. Convention February 25 to 28, incl., 1924, in Chicago.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago.

American Engineering Standards Commission; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth Street, New York City.

Associated General Contractors of America; G. W. Buchholz, Secretary, 1038 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 W. Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Rudolph P. Miller, President, Fred W. Lumis, City Hall, Springfield, Mass., Secretary.

Iowa Cement Stave Silo Association; H. E. Kilmer, Secretary, Oskaloosa, Ia.

Iowa Concrete Products Association; Ross Dowell, Secretary, 405 Hubbell Bldg., Des Moines.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

National Association of Manufacturers; John E. Edgerton, President; Henry Abbott, Treasurer; George S. Boudinot, Secretary, 50 Church St., New York City.

The National Concrete Stave Silo Association; W. G. Kaiser, Secretary, 111 West Washington St., Chicago.

National Crushed Stone Association; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East 22nd St., N. Y. C.

The National Lime Association; Mather Bldg., Washington, D. C.
Fifth Annual Convention, Hotel Commodore, New York city, June 13, 14, 15, 1923.

National Sand and Gravel Producers' Association; T. R. Borrows, Acting Secretary, 903 Munsey Bldg., Washington, D. C.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington Street, Chicago.

Wisconsin Concrete Products Association; D. R. Collins, Secretary-Treasurer, Milwaukee.

Trade Publications

What Contractors Say About Us—"A Profit in the Job"—this is the title of an attractively illustrated booklet of 20 pages, paper covers, issued by the Vulcanite Portland Cement Co. Important details in the manufacture of portland cement are illustrated by pictures showing various departments in one of the plants of the Vulcanite Portland Cement Co. Under the heading, "Interesting Facts About the Cement Industry," a brief summary of the development in the portland cement industry is given, with mention of some of the interesting steps in the manufacturing process.

While the new *Craftex Wall Finishes* of the Simmons, Gardner Co., 146 Summer St., Boston, Mass., are designed as a finish in place of paint and to some extent in place of plaster on surfaces of almost any material, they have a special field of usefulness in connection with a surface finish having color and texture for use over any wallboard or other material which does not expand or contract. Craftex is a kind of compromise between plaster and paint. It is put on with a brush, in a thick consistency, and is stippled or otherwise surfaced to suit the particular job. It is tinted, preferably with oil colors, as may be desired. It is said it will stick to any surface including tin, wood or even glass. It is sufficiently elastic so that it will not chip and peel off, due to ordinary wear and tear. It goes on about 1/16 of an inch thick, is mixed with water and ready for use the following day.

Smith Excavator and Loader is the title of a 20-page, two-color catalog just issued by The T. L. Smith Co., of Milwaukee. In addition to the usual description, illustrations, and specifications of the excavator and loader, there are several pages devoted to the five uses for which the machine is designed, namely: basements and general excavating and loading; bank excavating and loading of gravel, sand, etc.; stock pile loading of gravel, sand, coal, etc.; stripping of sand, gravel, clay and rock; grading of alleys, streets and general work.

Macleod Exhaust Systems and Dust Arresters—This is a 12-page pamphlet, 5½ in. x 7½ in. issued by the Macleod Co., Cincinnati, Ohio, describing and illustrating the Macleod dust collecting equipment and giving sizes capacities and other information.

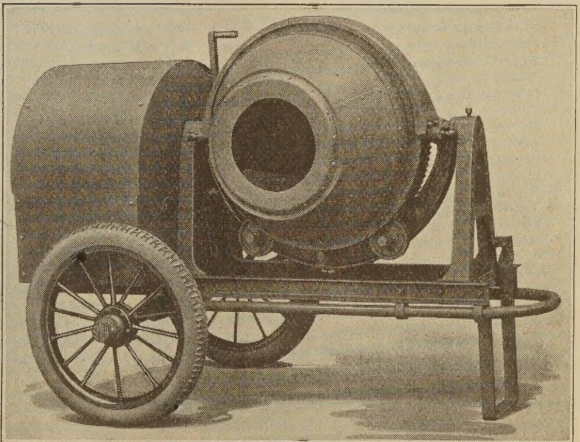
In the operation of the Macleod curtain dust arrester and collector, the separation is attributed to combined centrifugal action and the ability of a moving volume of air to create a suction over properly designed chambers, to thereby collect the dust that is thrown against these surfaces by centrifugal action.

Away From Methuselah is the intriguing title of a unique booklet recently published by the Crescent Belt Fastener Co., 381 Fourth Ave., New York city. It takes the reader back to the first belt joint made by the Cave Man in prehistoric times and sketches in semi-humorous style, the development of belt-joining from that era right up to the present. The booklet is enlivened with amusing cartoons, and makes very interesting reading, at the same time giving the reader a very clear idea of the history of belt-joining. The last few pages of the booklet are devoted to a concise description of Crescent Belt Fasteners with the whys and wherefores of the service they render. A copy will be gladly sent by the Crescent Belt Fastener Co. to anyone interested in increasing belting efficiency.

The Link-Belt Company of Chicago and Philadelphia recently issued a very comprehensive and instructive book on "Electric Hoists and Overhead Cranes." It is not only profusely illustrated with photographs of actual installations showing some of the most recent Link-Belt electric hoist applications, but with line and wash drawings, the subject of proper installation and efficient operation is fully covered.

New Small Mixer

The new Smith 375 tilting mixer just being placed on the market by The T. L. Smith Co., Milwaukee, is of half-bag size, built along exactly the same lines as the larger Smith tilting mixers. The double-cone drum, the central gear ring and roller track, the independent tilting frame—these are all the same in the mixers of larger size. The new mixer has a mixed batch capacity of 3¾ cu. ft. or a full half-bag batch of 1:3:6 mix with materials containing the usual 40% voids.

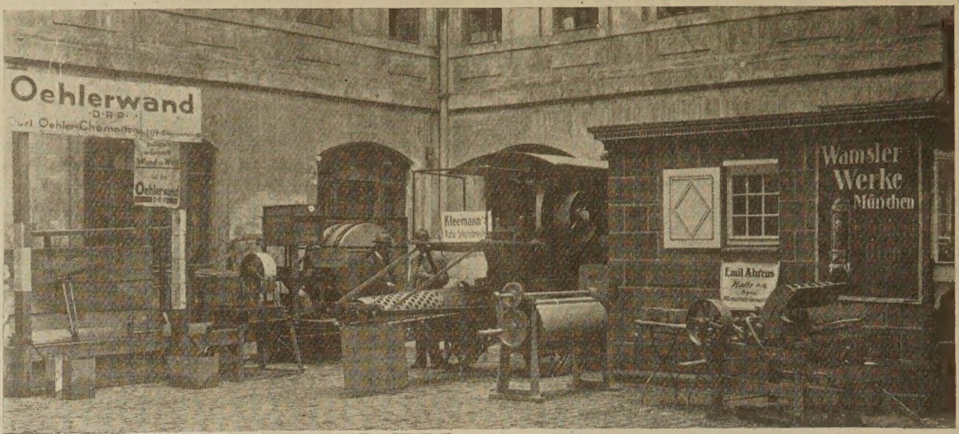


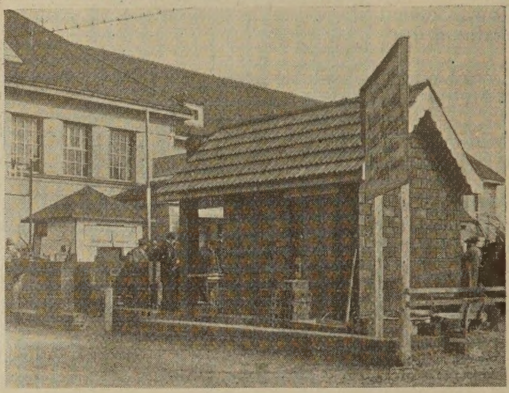
SMITH 375 HALF-BAG TILTING MIXER—TWO-WHEEL MODEL RW-1 CHARGING SIDE. THE PRESSED STEEL WHEELS ARE FITTED WITH CLINCHER RIMS FOR FORD 30 x 3½ PNEUMATIC TIRES

For power, there is a 1½ H. P. Fuller & Johnson engine, equipped with a magneto, completely housed. Model SW-1 has 4 steel wheels, while model RW-1 (shown in the picture) has two pneumatic-tired wheels, with a hauling stub that is so arranged that it can be drawn out for readily attaching the mixer to an automobile, truck or wagon.

Concrete Building Units and Machinery at Leipzig Fair

The use of concrete building units is becoming very general in Germany, according to a correspondent of CONCRETE, who sends the accompanying pictures of an exhibit of machinery and products at the Leipzig Building Fair. Blocks, bricks and special units of many types, including roof tile, were shown, in addition to works of reinforced concrete.





Concrete Street Markers and Lighting Posts

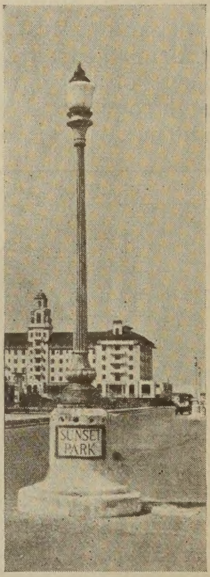


Fig. 1—Lighting Posts on Ocean Boulevard

Asbury Park, N. J., is equipped with concrete street signs and lighting posts. The street names are in vitreous tile, cut mosaic, black letters on a white background, with red "bright spot reflectors" placed in each case as shown in the accompanying illustrations. When the tile panels come from the manufacturer, they are placed in an iron form especially made for the purpose and thin concrete is poured in to fill the form. The letters are four inches high, and easily read for one hundred or more feet. Street labor is employed on stormy days when other work cannot be done, and six finished products can be ready for curing when two men work two hours.

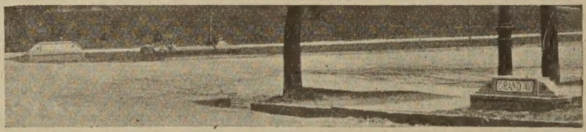


Fig. 2—Markers on Two Corners of Intersection

The markers are placed on the ground at the four corners of intersecting streets. They always read to the right and are directly in the line of travel so that the motorist does not have to take his eyes off the street ahead in order to read them. The sign posts are so arranged that they punctuate the center line of the street. They are not more expensive to place than good metal enameled signs on posts, and are ornamental rather than unsightly.

This system of street marking was provided by Street Commissioner George W. Pittenger, who after considerable study of the problem decided to eliminate the old painted wood or enameled iron signs fastened on poles and trees and substitute permanent markers and posts of concrete.

If you have an idea that you have used with success, pass it on to the other fellow in exchange for other ideas—in CONCRETE.